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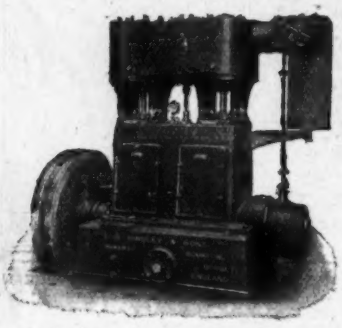

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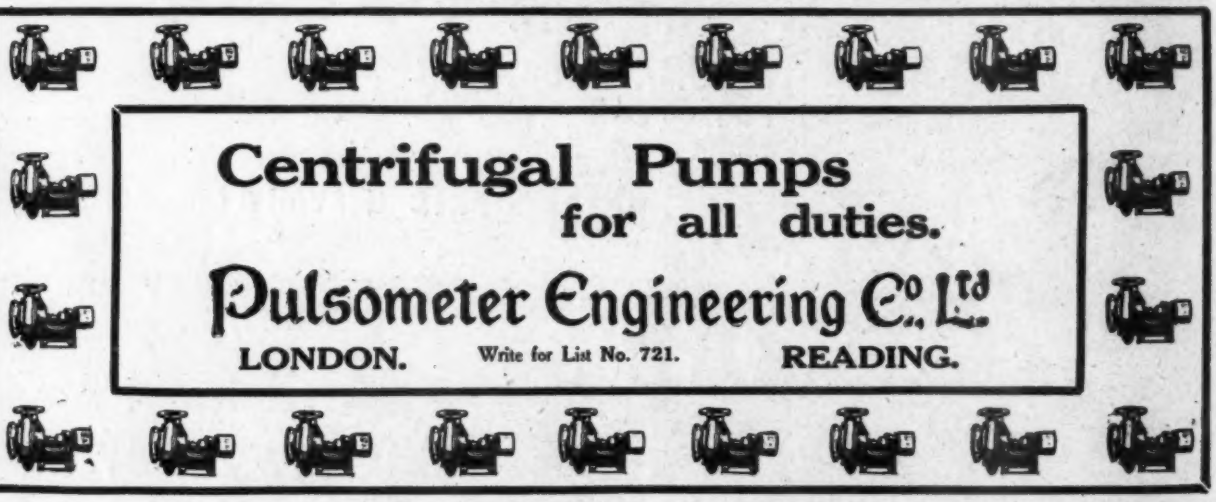

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PARIS TRAMWAYS AND WAR TROUBLES.

A TYPICAL instance of the difficulties with which French tramway companies have to contend under the conditions of the war is afforded by the experience of the East Parisian Tramways Co. (Tramways de l'Est Parisien), whose gross profits in 1916 were less than in the preceding year, and which succeeded in equalising the expenditure in 1916 only as a result of the gross profits which were realised on the manufacture of munitions of war. These matters are fully set forth in the company's annual report, and amplifications were given by the chairman at the recent general meeting, particular interest being manifested in figures showing the great advance in the cost of materials as compared with the period before the war.

The report states that, while the normal working conditions upon which the fares fixed by the company's concession were based have been completely changed by events which could not be foreseen, and while the sale prices in trade and industry everywhere have increased at a rate corresponding to the advance in cost prices, the company are prohibited from making any modification in the fares to be paid by passengers. The steps taken by the directors with the object of securing a change on the part of the local authority which granted the concession have had no effect, and the intervention of the Government has only been manifested in the direction of increasing the company's burdens by enforcing the grant of war bonuses to the tramway workers, whereas such bonuses, it is contended, should have been simultaneous with the giving of permission to raise the fares. In addition, the conceding authority, persistently ignoring the state of war, has applied the penal clauses of the concession contract by inflicting daily fines upon the company for the non-observation of the time tables in operation in peace times, whereas the present conditions render it impossible to adhere to these time tables absolutely. Not only so, but despite numerous applications, the company have not yet been authorised to bring into operation certain advantageous arrangements in the concession contract which only require the fulfilment of certain formalities which were already concluded some time ago.

The difficulties which were referred to in the report for 1915 have been accentuated with the continuation of the war. Although the company were eventually empowered to extend the use of female labour in the working of the cars, it is not possible to maintain the effectives without trouble, and the maintenance staff n particular has not been adequately reconstituted. The scarcity of specialised labour, and the impossibility of obtaining all necessary raw materials and spare parts for the maintenance of the rolling stock and tracks, have compelled the company to limit their efforts to the execution of the most urgent works, the others being postponed for the future. The same circumstances have prevented the execution of renewals to the extent followed in normal times, but the delay will be overtaken as soon as the means are available. It has, however, been possible to double four lines in connection with the scheme for the reorganisation of the system.

M. Bousquet, chairman of the company, directed the attention of the shareholders at the meeting held in 1916 to the exceptional charges which the company had to bear, and which arose from (1) the enhanced cost of raw materials, (2) the increased cost of coal, and (3) the rise in wages.

Amplifying this information at the recent meeting, the chairman quoted the following figures in regard to the prices which prevailed before the war and those which were charged in June, 1917 :—

The Cost Prices of Materials in France.

	Pre-war period in 1914. Francs.	June, 1917. Francs.
Cast-iron	35·00	110·00
Cast-steel	90·00	240·00
Brake blocks	18·00	75·00
Trolley poles	21·00	63·50
Wheel tires	36·00	115·00
Tool steel	8·00	35·00
Copper wire	230·00	670·00
Oak wood	1·50	5·40
Motor oil	45·00	210·00
Coal	29·00	182·00

The chairman did not mention the weights, &c., to which the figures apply, excepting in the case of coal, but the differences are sufficient for the purpose of illustrating the great advance. The cost of the imported coal relates to the tonnage price delivered at the company's power station, the coal having to be conveyed from the ports up the Seine as far as Vitry. In this connection it is stated that the coal now being received is far from equalling that which was supplied prior to the war. The mines, the chairman explained, are no longer worked with the same care as in times of peace, and the coal forwarded is not well sorted or well washed, so that it does not yield the same efficiency. For instance, the consumption of coal at the company's power station, which amounted in peace times to 1,300 grammes per KW.-hour produced, has now risen to 1,450 grammes per KW.-hour, so that a larger quantity of coal has to be consumed in order to obtain the same quantity of energy. The chairman also referred to the labour question, and mentioned that a further war bonus of 0·75 fr. per worker per day has been compulsorily imposed upon the company by the Government, making a total advance of 1·50 fr. per individual since September, 1916.

The effect of the increases under the foregoing three classes has been to double the working expenses per car-kilometre run, as contrasted with the pre-war period. This fact is illustrated by the following figures concerning the working expenses in the first four months of the five years mentioned :—

Working Expenses per Car-kilometre.

First four months of 1913	0·559 fr.
" " " " 1914	0·564 "
" " " " 1915	0·767 "
" " " " 1916	0·776 "
" " " " 1917	1·069 "

The chairman, in conclusion, again referred to the question of fares, and remarked that it was impossible for the State to recognise the necessity for an increase in railway fares, which had been sanctioned, and to refuse to give the company any compensation in the same direction. During the discussion attention was drawn to the fact that certain tramways, notably the tramway from Paris to Bourg-la-Reine, had raised their fares by 25 per cent. It was explained, however, that the particular undertaking concerned was not a tramway, but a "railway of local interest" (light railway)—the Compagnie de Chemin de Fer sur routes de Paris à Arpajon—which is not subject to the same *régime* as the tramway companies in the Department of the Seine.

Electricity Supply Restrictions and Prices in Germany.

As a result of the comparative scarcity of coal in Germany, owing to the great demand and the shortage of mining labour, the Government recently issued an order placing restrictions on the consumption of gas in general, and this is about to be followed by a similar order in relation to the use of electricity. The object in each instance is to effect economy in the consumption of coal, and new connections to the distributing mains will only be permitted in cases which are officially considered to be very urgent.

A war-tax on the sales of coal as from the pits was brought into force on August 1st, and producers are authorised by law to add to the accounts rendered to customers the amount of the increase arising from the imposition of the tax. In their turn, the electricity supply companies and local authorities who own supply works are also empowered, as from August 1st, to transfer to consumers the additional burden resulting from the greater cost of coal. The German War Office authorities, through the Imperial Commissioner for Gas and Electricity, have now issued a communication pointing out that since the beginning of the war the prices of coal have risen by 100 per cent., and even higher, and those of other raw materials by several hundreds per cent., whilst, at the same time, wages have advanced to an extraordinary extent. In addition, the gas and electricity supply works have also assumed considerable burdens in the direction of contributing towards the support of the families of those workmen who have been called up for army service. As a consequence, the calculations upon which supply contracts entered into before the war were based, have been completely upset. It is therefore contended that large consumers, although in individual cases having the formal right on their side, reasonably can no longer ask to be supplied at prices which result in a loss, when they themselves realise ample profits from the sale of manufactures at prices corresponding with the general advance in the costs of production. It must consequently be expected, it is said, that large consumers, just as the Government departments have done on the production of proofs of the disproportion between prices, will consent to pay to the gas and electricity works an increase in price equivalent to the expansion in the latter's cost of production.

The official communication proceeds to state that the influences of war conditions on the tariff rates arranged in the contracts for the supply of small consumers are still more surprising, as in these cases other matters come into consideration besides the growth in working expenses. For instance, the expenses of making connections for consumers are paid on the assumption of lasting and unhindered utilisation, and the tariffs were fixed on the assumption of a minimum period of consumption in the case of the installations connected up. But these contract conditions have partly experienced a decisive change and partly been abolished by the introduction of "summer-time," the restrictions imposed by local authorities on the consumption of light and power, and the stoppage of establishments or of machinery, as, for instance, bruising mills in agricultural districts. Moreover, numerous small consumers have been requisitioned for the army, and either do not meet the obligations they assumed on the connections being made, or only do so incompletely.

A large number of towns and communes for the foregoing reasons have voluntarily consented to pay an increase in the tariff rates charged to them, the advance frequently being regarded as appropriate at 25 per cent. It is held to be in the interest of the local authorities for the gas and electricity works to be maintained in an efficient condition, and in their decisions the latter cannot leave out of consideration the fact that working during war time is associated not only with a very unusual growth in the working expenses, but also with an extraordinary depreciation of the plant, and that materially higher prices will have to be paid for renewals after the war. The War Office authorities, under the circumstances, conclude by stating that they consider it requisite and just for consumers to pay to the works prices which correspond with their increased costs of production in the interest of the works being maintained in regular operation.

SOME SUGGESTIONS FOR THE PREVENTION OF MISTAKES IN METER READING.

By G. W. STUBBINGS.

The periodical reading of consumers' meters was, before the war, a business that was carried out smoothly and with little trouble. Meter readers were thoroughly accustomed to their work, and mistakes were of comparatively infrequent occurrence. In present circumstances, when men and women of little or no previous experience have to be put on this class of work, mistakes are considerably more frequent. The operation of meter reading is peculiar, in that the person engaged on the task works quite by himself, and cannot be supervised in the same way that other employés are. Mistakes, moreover, may be of far-reaching consequence, causing friction with consumers and involving great trouble for their satisfactory adjustment. It is therefore desirable to inquire into the various possible mistakes that can be made, the probable causes of the same, and also to consider the question as to what system of instruction will best fit the new meter reader to perform his or her work speedily and accurately.

The most serious error likely to be made is that of misreading the meter, as this is the most unlikely to be immediately discovered. The operation of meter reading, although seeming so simple to those thoroughly accustomed to it, gives great trouble to beginners. The difficulties are greatly increased by meters being fixed in bad positions for reading. It is always worth the expense of a few feet of cable and tubing to arrange for the meter to be in a position convenient for reading, as the possibility of error will be greatly reduced. A meter is not like a service cut-out, which has only to be examined in unusual circumstances, but is fixed in a building expressly in order that it may be read periodically. Meter dials should be as large as possible, and have bold plain figures; and these dials should be in a line, in the correct sequence. Some meters have three dials arranged in equilateral triangular fashion, and it requires a close inspection of the meter to discover the correct order for reading. With cyclometer or jump counters, the possibility of error should be largely reduced, but difficulties are often introduced by the necessity of having the eye of the observer level with the counter for reading. Furthermore, counters having figures engraved on white metal barrels are difficult to read in a bad light. A good dial counter can be read while at a level of 2 or 3 ft. above the eye, in a moderate light. It is of great importance in a cyclometer counter to have the decimal figures plainly marked. A red comma is not sufficient, and means should be employed to make the distinction quite obvious. Meter readers should always be instructed to read meters of large capacity with extra care, and thoroughly to examine the dial before so doing. With such meters the last dial to the right sometimes reads 10 per division. If it is the custom to set dial counters to zero in the test room, this should be carefully done, otherwise inconsistent readings of adjacent dials may cause the meter reader to blunder.

Conscientious meter readers can usually discover serious errors of reading by comparing the consumption indicated for the current quarter with that for a previous corresponding period, making intelligent allowances for altered circumstances. If meter readers could only be trained to take this simple precaution before leaving consumers' premises, and also to check their reading if the consumption appeared at all different from what should be expected, serious errors would be largely avoided. To encourage this to be done, it is not advisable to insist unduly on speed in meter reading. Accuracy is the first essential; speed, whilst being desirable, and characterising an efficient meter reader, is only secondary.

Some meter readers are very prone to errors in subtraction. This mistake is, of course, immediately detected by the clerical staff dealing with the readings, but it involves a journey to the consumer's premises to correct his meter-card, and not infrequently elicits from the consumer a facetious letter informing the department of what they have already found out. This error can be avoided if the meter reader will perform the subtraction twice—once in the meter reading book and once on the consumer's card—and then compare the results of his two calculations. This simple precaution is very difficult to get carried out, as usually the meter reader copies from the book to the card, or *vice versâ*.

Errors sometimes occur on premises having more than one meter, by confusion of the meters, and entering up the reading of one on the page in the book allotted to the other. This is usually due to gross carelessness; but, nevertheless, the system of marking the owners' numbers on meters should be a good one, and it should not be necessary for the meter reader to scratch a rusty label in order to discover such number. The system of stencilling owners' numbers on the glass, or marking it on the dial, has much to recommend it from the point of view of meter reading. This method should, however, only supplement, and not displace, the more permanent brass label.

It is an excellent practice for meter readers to try all meters on one light, or on the smallest load possible. This is not always convenient, but if the consumption shown by the meter differs considerably from that of the corresponding period of the previous year, a special effort should be made to do this. It is to be remembered that a meter does not usually stop suddenly, but gradually gets slower on low loads, with a gradually increasing starting current. A meter may show a satisfactory consumption, and, indeed, be accurate on the usual load of the installation, while stopping on one light. Next quarter such a meter may fail altogether, necessitating an estimated consumption and the possibility of dispute. Systematic inspection of meters whilst reading, and changing those unsatisfactory on one light, will greatly reduce meter stoppages. It is a good plan to have a small column provided in the meter reading book, in which a tick can be made if the meter has been tried. A different mark should be made when the meter was found going, as in the case of a power load. When readings are being examined by the consumer's clerk, those showing an unsatisfactory consumption, the meter not having been tried, can be held back in order that this may be done.

Meter readers should be instructed to endeavour not to talk to consumers, and not to express any opinion regarding any complaint they may have to make. Such a discussion is not only a waste of time, but sometimes gives rise to disputes, owing to the consumer alleging that the meter reader said something that he either actually did not say, or did not intend to say. Meter readers may be betrayed into expressing some opinion which will subsequently be quoted by the consumer as having been offered by an authorised representative of the supply authority. Meter readers should, therefore, tell consumers to make their complaints by letter. The same applies to requests by the consumer for work to be done, or minor alterations to be carried out. In cases of low consumption the meter reader might inquire of the consumer as to the reason of the same, and make a note of such reason. This will be useful, as at some future time an estimated consumption may have to be made, when the consumer may endeavour to get the low consumption, which really was due to abnormal conditions, taken as a criterion for estimation. The instruction to avoid, as far as possible, conversation with consumers must not, of course, be taken to absolve meter readers from the natural obligation to be courteous, and to endeavour to cause the consumer as little inconvenience as possible.

Seals should be examined on meters, and, as far as practicable, on service cut-outs also. It is, however, advisable for service cut-outs to be separately inspected and examined periodically. These cut-outs are often fixed in out-of-the-way positions, and to insist on an inspection of the seals by the meter reader would unduly delay the readings; while, quite possibly, some cut-outs would never be inspected. A separate inspection—say yearly—of service cut-outs is therefore desirable.

It is a good plan for the electricity department to have drafted a set of instructions representing the practice of the department regarding meter readings. Such instructions should be typewritten, and a copy should be given to each meter reader for thorough perusal. A suggested set of instructions is as follows:—

Instructions to Meter Readers.

1. Read meter twice, once for meter book and once for consumer's card. Subtract twice to obtain consumption, and, finally, compare entries in card and book. Do not copy from card to book, or *vice versâ*.

2. If consumer's card be full, make out a fresh one. If the consumer has difficulty in finding the card, request that it be kept near the meter.

3. Endeavour to try all lighting meters on one light, and power meters on the smallest load possible. If the meter is satisfactory, make a tick in the column provided. If the meter will not work on one light, ascertain the smallest number of lights on which it goes, and note this in your memorandum book.

4. If the meter be found stopped, make a note of this, and also of the reading, but make no entry either in the meter reading book or on the consumer's card.

5. Compare the consumption with that for the corresponding quarter last year. If markedly different, check the reading, and, if low, try the meter, if this has not been done. If all is satisfactory, inquire of consumer the reason of the abnormal consumption, and make a note of the same.

6. Complaints of high consumption, or verbal orders for work to be done, are not to be taken by meter readers. Inform the consumer that such complaints and orders must be made in writing.

7. While always being civil to consumers, endeavour to have as little conversation with them as possible. Above all, refrain from expressing any opinion regarding any complaint they may have to make.

8. Inspect seals on meters, and also, if possible, on cut-outs, noting any missing. Make a note also of any broken meter or cut-out glass, or any apparently defective wiring you may come across.

THE QUESTION OF "THE STAFF" IN ENGINEERING ESTABLISHMENTS AFTER THE WAR.

[COMMUNICATED.]

At the present time discussions anent the extreme importance of harmony existing between workman and employer are as plentiful as leaves in autum.

It is laid down as an axiom, and quite rightly, that the workman must turn out more work, and be permitted to earn higher wages, than tradition has approved of in former days; and that the manufacturer must have his works full of good orders, which will be obtained solely and simply by the fact that he can turn out articles by the 100,000, with the aid of automatic machines worked to their full output, enabling him to place his wares on the market at an extremely low price.

At the same time, we hear on every hand of the necessity of better and wider education for engineers; of the necessity of technical preparation for even the coming generation of workmen; and of insistence on study for two or three years at an institution of university standing for those who would take commissioned rank in the new engineering army.

Whilst in its way all this discussion may be quite good and necessary, it seems to the writer that the interests of one important section of the engineering army have been overlooked entirely. This section is that generally known as "The Staff"—usually spelt with a large S when referred to at annual dinners on the occasion of the annual back-patting exhibition, and with a very diminutive s when its salary is being considered.

To say that in the past, and even to-day, the staff—in which term are included all technically-trained men, whether in the drawing office, the test-bed department, or on administrative work—have been underpaid and shabbily treated, is to state a platitude. Yet, without this body of men, the engineering industry would be impossible in this or any other country.

Let us consider for a few moments what the training and work of men engaged in such appointments include, and then consider their remuneration. A young fellow after spending, say, four to six years at a good grammar school, has usually entered some works as an apprentice, with an agreement to go through all departments, and to finish up in the drawing office; certainly, during the last 20 years, it has not been the invariable custom to pay a premium for this privilege, but a low rate of wages, and in many cases no wages at all, have been the rule.

Diligent work during the day has been supplemented by study in the evenings, the man's general education probably having taken him at least up to quadratics and through a considerable portion of Euclid, and given him also a good foundation in physics and chemistry. At the evening technical school this man has been enabled to enhance his theoretical knowledge to a considerable extent; opinions of people interested in purely day courses notwithstanding.

Thus, at the end of five or six years, by the time the man has attained the age of 22 or 23 years, he has a good practical acquaintance with actual commercial work, and a very sound theoretical education, especially in applied subjects. And let it be remembered that this training has cost him no small amount of study and thought, of a particularly tiring and concentrated type.

The same course of training has often been followed by the boy coming from a rather lower social stratum, who has worked his way from the elementary Council school up to a higher grade school, and there obtained a good sound drilling in mathematics and practical science.

Both these men will be engaged as draughtsmen for some time after they have become 21 years of age, and will be quite ready to work in subordinate appointments as long as they can gain wider and more valuable experience.

They expect, and the writer upholds them in this view, that by the time they are 25 or 26 years of age they should be able to earn, in ordinary peace time, at least £120 to £130 a year. It is well known, however, that in ordinary times this salary is not paid to a man unless he is doing responsible—in fact, very responsible—work, involving fairly difficult calculations, and at least a good working knowledge of the plant he is assisting to design, whilst he is usually nearer 30 than 25 when he reaches this meagre salary.

A step on the ladder of promotion, often looked forward to with some amount of eagerness, arrives when the draughtsman is asked, at about the age of 28 years, to go down to the works of some customer of the firm, and witness a test on some of the firm's plant.

This is responsible work; and the writer has known men almost live on the job for ten days or a fortnight on end in order to achieve guaranteed results and to give satisfaction to a customer.

Work of this type demands that a good and really smart suit of clothes be worn whilst the firm's client is being visited, and it is worthy of remark that the draughtsman provides this suit out of his own pocket; and if he is not willing so to rig himself out, he will certainly not be sent on such work.

That a smart appearance is necessary on such work is undeniable, but to expect a man on £130 a year to keep such an appearance going is in every way unfair, especially as this type of work soon ruins his clothes.

All that such men get out of such appointments is a few days at a more or less good class hotel, and, as a rule, anything from a week's to a fortnight's harassing work, which extends from first thing in the morning to late in the evening.

Naturally, having been on such work confers some amount of distinction on a man, and on first getting such work to do he is elated at his prospects. Time, however, soon shows him that he is not the only man to possess such experience, and that his value in the open market is but little enhanced on that account.

It is at this stage that dissatisfaction sets in, and it is fortunate for the man himself, the profession to which he belongs, and the country in general, that he so seldom turns out of the straight path, but contents himself with grousing and preventing his own or his friends' children from following in his footsteps.

On the other hand, there are some reckless and daring spirits who will not sit down under what they consider a grave injustice, and so decide to make society in general give them an income more in keeping with their talents than ordinary straight going will provide.

To the writer it seems obvious that the scandalous underpayment of staff engineers is nearly always at the bottom of these regrettable wrong-doings.

No decently educated fellow is going to risk his future career, and, above all, his honour and reputation, unless he has been brought to such a state of bitterness at his prospects in life, compared with the standing he should occupy and the salary he should receive, when the national importance of his work is considered, that he loses all caution, becomes reckless, and decides that the community which confers thousands a year, or even a month, on tricky company promoters, shall be laid under toll to his brains and abilities, for something better than a mere pittance.

The writer asks for no sympathy for such men, they must be put out of the reach of doing such mischief; but he does ask the great industry to which they belong to reflect that when such ability goes so far wrong, there must also be something radically at fault with the management of the industry itself.

Above all, it must be admitted that, to a man educated as outlined above, £200 a year at 30 years of age, with the off-chance of £350 by the time the age of 38 or 40 is reached, is only a meagre prospect.

What, then, must the prospect appear to those whose parents have, in addition to the training outlined, spent the necessary money to give their sons a theoretical education of University standard, such as is being called for to-day?

The prospect is practically ridiculous; and when it becomes realised, it will prevent men coming into engineering, with the consequence that either the British engineering industry will not be equipped with the type of official staff required for the very strenuous conditions immediately before us, or it will be necessary to call in the well equipped foreigner, who works for a pittance in return for learning our language, our ways, and the general lay-out of our works, the towns in which they are situated, and the roads and railways which lead to them; for it is in this way that the low-priced foreign staff engineer has taken his full payment.

To conclude, the writer draws from his own experience. Educated for some years at a well-known grammar school, he, along with others, went into engineering in the manner previously outlined, and was also a day student after reaching the age of 21.

Having always kept in touch with the "Old Boys" Association, it is pleasurable and profitable, once or twice a year in normal times, to foregather and talk matters over with the fellows who were for years in the same Form, and who went up the school in work and play alongside oneself.

Practically in every case the men who have gone into commercial pursuits, such as banking, have not only done better, from a salary point of view, than the engineers, but have had much less study to obtain their positions; whilst they are free from quite half the worry which a similarly paid engineer has to put up with, and rarely, if ever, have to face the personal discomforts and risks which are a portion of the staff engineer's daily routine. Consequently, one meets one engineer after another who does all he can to discourage suitable boys from taking up the profession, and who, as a rule, absolutely forbids his own progeny to take it up.

The workman has to be considered, because he is ready to fight. Do the heads of our great engineering firms wish to make the staff man think that he, too, will never receive fair remuneration, or fairly reasonable security of tenure, unless he also prepares to defend his interests in the same manner?

Stinginess in granting war bonuses to meet the higher cost of living, and the general absence of any idea of remembering the wants of the staff, in making after-war arrangements, go a long way to confirm this idea.

Let us hope that, before it is too late, this oversight will be remedied.

THE PLIOTRON OSCILLATOR.

In our issue of May 28th, 1915, we described the pliotron, and its varied uses in wireless telegraphy and telephony; as there explained, its operation depends upon the passage of current between electrodes in a high vacuum by means of pure electron discharge—the thermionic current. The pliotron has not yet made its appearance on the market in this country, but its construction and applications are being developed in the United States by the research laboratory of the General Electric Co., of Schenectady, and in the *General Electric Review* for August Mr. W. C. White describes its use for obtaining either a large current or a high voltage at high frequency.

When used as an oscillator for the production of alternating current from a direct-current source of energy, the pliotron has the characteristics of an amplifying relay; that is, the wave shape of any variable E.M.F. applied between the electron-emitting cathode and the grid (or controlling member) will be faithfully reproduced by the current in the main anode-to-cathode circuit. Hence the input of a small amount of A.C. energy will set up a relatively larger amount, identical in frequency and wave shape; and by utilising a small proportion of the A.C. energy thus produced to feed back to the input circuit, the system can be made self-exciting; A.C. energy can thus be obtained from a D.C. source, the pliotron and its auxiliary apparatus forming a type of converter.

For laboratory and testing purposes, there is considerable use for constant-amplitude high-frequency electrical energy.

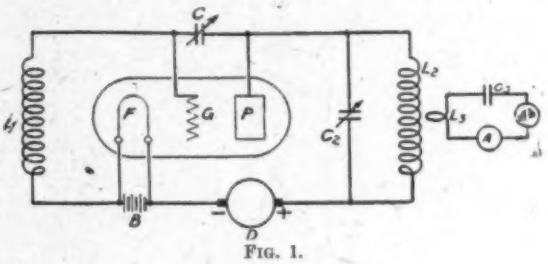

Fig. 1.

For instrument and meter calibration, heavy high-frequency currents are often required, the actual amount of electrical energy dissipated being comparatively small.

In the case of tests on insulating materials to ascertain dielectric strength and dielectric losses, high-voltage high-frequency is often necessary, although in this case also the amount of electrical energy required is small.

Two pliotron oscillator arrangements for high-frequency are described, the first for the production of relatively large current and the second for the production of relatively high voltage. In each case the amount of energy involved is comparatively small, of the order of 150 watts or less.

In a resonance circuit the current will rise until the losses become equal to the input energy. With practical circuits the lower limit of power factor obtainable is about one half of 1 per cent., unless unusual precautions are taken. This means that the maximum resonance current produced is about two hundred times the value of the true energy current fed into the resonance circuit.

Therefore, where large currents are desired from a small quantity of energy, the total volt-amperes of the circuit must be kept small; and this condition requires that for such a resonance circuit a large capacity and small inductance must be used.

It is also important to adjust the resistance of the load to the voltage of the supply so that the energy is most economically utilised. This means that the resistance of the heavy-current circuit must be given the apparent value most suitable for insertion in the pliotron circuit. This adjustment of apparent resistance is accomplished by electromagnetic coupling or transformer action.

The diagram of an arrangement to produce currents of from 10 to 25 amperes from one pliotron tube at frequencies between 100,000 cycles and 1,000,000 cycles is shown in fig. 1.

Suppose it is desired to calibrate a hot-wire ammeter by

means of direct comparison with a standard. These two ammeters are represented by A and A_1, and are connected in series as part of a resonant circuit, the inductance and capacity of which are shown at L_3 and C_2 respectively. The product of the values of L_3 and C_2 to be used for any particular case is found by the usual resonance formula—$f = 1/2\pi\sqrt{(L\,C)}$.

As mentioned above, a low power factor and volt-ampere product is desirable; and therefore the inductance value of L_3 is made the minimum possible, consisting usually of only one or two turns of heavy conductor. With the range of frequencies specified, this gives values for C_2 of the order of about 0·1 microfarad. In this heavy-current circuit it is, of course, very necessary to use condensers of low energy loss, and to reduce the ohmic resistance of the conductors to a minimum.

The inductance L_3 obtains energy by electromagnetic coupling from the coil L_2, which is connected in the plate circuit of the pliotron.

By means of an adjustment of the values of L_1, L_2, and C_1, the pliotron system can be made to set up a high-frequency current corresponding in period to the tuned heavy-current circuit.

Owing to the relative values of L_2 and L_3, the apparent resistance in the plate circuit of the heavy-current load circuit is greatly multiplied, but still is not of a sufficiently high value to absorb all the available energy. Further to

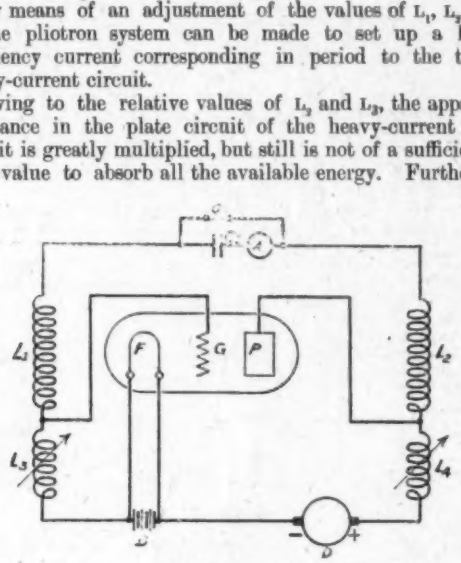

Fig. 2.

increase this apparent resistance, a variable capacity C_2 is shunted about the inductance L_2. Then, by simultaneous variation of these two factors, the apparent resistance of the load can be adjusted to give the largest energy output available.

The heavy-current output is dependent upon the voltage of the direct-current source D, a useful range being between 200 and 750 volts. Pliotrons may be operated in parallel to produce a load current larger than that obtainable from one tube.

For the production of high voltage in a resonance circuit, the conditions are almost the reverse of those in a heavy-current circuit; that is, with a fixed value of inductance and capacity to give the desired frequency, the capacity must be small and the inductance relatively large.

A pliotron oscillator arrangement for the production of high voltages is shown in fig. 2. The high voltage is obtained across the condenser C_1, and may be tested by the gap G. A condenser in the form of two metal plates suspended in air* is the most convenient, and it may have a capacity value between 20 and 200 micro-microfarads for a frequency of 100,000 cycles. With a hot-wire ammeter A in circuit with the condenser, and knowing the frequency, the voltage produced across C_1 may be simply calculated.

The inductances L_1 and L_2 are similar, and each has a value of about 8 millihenries. The invariable inductances L_3 and L_4 are also similar to one another, and each has a maximum value of about 2·5 millihenries.

The object of having L_4 variable is for the purpose of applying the high-frequency energy from the pliotron to the resonance circuit at the correct voltage, so that the energy available is used most advantageously in the resistance of this circuit. The inductance L_4 is made variable so as to supply to the grid just the right amount of high-frequency energy to make the system self-exciting and to excite it in the most efficient manner.

As in the case of the arrangement for heavy currents, a suitable range of potential for the direct-current source is from 200 to 750 volts.

With such values of inductance and capacity that a frequency of 100,000 cycles is obtained, a voltage of 12,000 may be produced from one pliotron tube operating from a direct-current source of 500 volts.

Pliotron tubes may be operated in parallel for the production of a voltage higher than that obtainable from a single tube.

* Two metal plates, each 10 in. by 10 in. and spaced ½ in. apart, give a condenser having a capacity of approximately 40 micro-microfarads.

A NEW HIGH-TENSION METER.

Up to the present, "high-tension" electricity meters have consisted simply of low-tension meters coupled to the high-tension circuit by instrument transformers, and subject to various errors and inconveniences due to the use of these transformers. The trend of modern power generating and distributing policy is such that it is necessary to base tariffs on high-tension current and to measure consumption in front of the consumer's step-down transformers. The meter described below* contains only low-tension components, but it avoids the use of instrument transformers by using in their stead the consumer's step-down transformer itself. The energy $P_h \cdot t$ delivered during a time interval t to the high-tension terminals of this transformer is given by:—

$$P_h t = P_l t + P_o t + [R_2 I_2^2 + R_1 (I_1 - I_o)^2]. t$$
$$= (P_l + P_o + P_r) t$$

where P_l = power at low-tension terminals of the transformer; P_o = light-load losses of transformer; R_1, R_2 = resistances of high-tension (primary) and low-tension (secondary) windings respectively; I_1 = primary current; I_o = light-load primary current; I_2 = secondary current; $P_r = R_2 I_2^2 + R_1 (I_1 - I_o)^2$.

This method of measuring the energy delivered to a transformer is on the same principle as the separation-of-losses method of

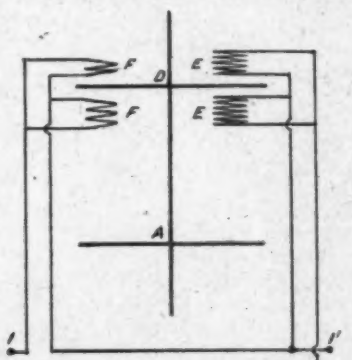

Fig. 1.

measuring power and determining efficiency during tests on electrical machinery or transformers. The measurement of $P_l t$ is effected by an ordinary low-tension meter, and that of $P_o t$ and of $P_r t$ is effected by special components, which may constitute a separate meter with its own train, or operating on the same train as the main low-tension meter. It is best, however, to let the special components act directly on the moving element of the main meter. This meter is then subjected, directly it is connected in circuit, to a relatively large driving torque due to a distinct element or part. Further, since the light-load losses of a transformer are practically constant, the starting torque on the meter is also constant. This simplifies and makes more accurate the adjustment of the main meter at all loads, and avoids the difficulty otherwise experienced in securing accurate adjustment at low loads. The danger of creeping and the effect of friction on starting are avoided.

Fig. 1 shows digrammatically the special components recording $P_o t$ and $P_r t$ (the ordinary windings recording $P_l t$ are omitted for simplicity) in a single-phase meter recording the energy supplied to a single transformer. In this figure, A represents the main moving element of the meter, which may be a motor meter or a rotating-field meter; D is a metal disk, on the same spindle as A, and acted on by windings E E, F F, which record respectively $P_o t$ and $P_r t$. The windings E E are of different reactances, connected in parallel between the two secondary mains. If U_2 be the secondary P.D. of the transformer, $r r'$ the resistances of the two coils E E, and

* From a paper by P. F. Dufour, *Rev. Gén. de l'Electricité.*

ϕ, ϕ' the phase displacements of their currents with regard to U_2, the driving torque exerted by E on D is proportional to $(U_2^2/r r^1) \cdot \cos\phi \cdot \cos\phi' \cdot \sin(\phi' - \phi)$. Again, if U_1 be the primary P.D. of the transformer, and θ_o the phase difference between U_1 and I_o, the light-load loss of the transformer is given by $P_o = U_1 I_o \cdot \cos\theta_o = (U_1^2/R_1)\cos^2\theta_o$. On light load $U_2 = m U_1$ (where m = light-load ratio of transformation); and in order that the driving couple produced by E may be proportional to P_o, it is sufficient if $\cos^2\theta_o = \cos\phi \cdot \cos\phi' \cdot \sin(\phi' - \phi)$. The angles θ_o, ϕ and ϕ' vary with frequency and with the self-induction of the transformer and the coils E E. By adjusting the core saturations of the latter, the desired relationship can be obtained within the necessary limits. Also, the variations in $\cos\phi$ and $\cos\phi'$ can be made practically proportional, so that our desired relationship becomes $\cos^2\theta_o = \cos^2\phi \cdot \sin(\phi' - \phi)$, which is realised by making $\phi = \theta_o$ and giving to $\sin(\phi' - \phi)$ a value near enough to unity so that a relatively large variation in $(\phi' - \phi)$ corresponds only to a small variation in its sine.

When the secondary of the transformer is loaded, the ratio of transformation is no longer constant but varies with the intensity and phase of the secondary current. Hence, in order that E E may continue to yield a driving torque proportional to P_o, it is necessary to apply a correction to its field proportional to I_2 and to a function of the phase displacement θ_2 between I_2 and U_2. As shown by fig. 2, U_2 is the resultant of $m U_1$ and the total voltage drop V S. The angle S O V is so small in practice, that O S may be taken as equal to its projection on O V, hence $U_2 = m U_1 - K I_2 \cos(\theta - \theta_2)$, where $K = \sqrt{[(R_2 + m R_1)^2 + \omega^2 (L_2 + m L_1)^2]}$, and is practically constant in industrial practice. Transposing this expression for U_2, and substituting the value for U_1 in $P_o = (U_1^2 \cdot \cos^2\theta_o)/R_1$, we have that $P_o = U_2^2 \cdot \cos^2\theta_o + A \cdot U_2 I_2 \cos(\theta - \theta_2)$, very nearly, where A is a constant. In other words, we have to apply a corrective torque proportional to $U_2 I_2 \cos(\theta - \theta_2)$. This may be done by adding to the coils E E, a winding connected in series with one of the phase wires, or in shunt with a resistance so connected (*e.g.*, in shunt with one or both of the windings F F). The corrective winding may be arranged to compensate the field of each of the coils E, so that these fields remain as nearly as possible proportional to the primary pressure U_1, or it may be in the form of a special coil which, together with the coil (or coils) E and the disk D, forms a small rotating-field meter yielding a torque proportional to $U_2 I_2 \cos(\theta - \theta_2)$. The two systems E F make possible adjustment to compensate for small errors involved by the assumptions made above.

Instead of using one coil, E, and a winding traversed by all, or part, of the current I_2, the corrective torque may be provided by

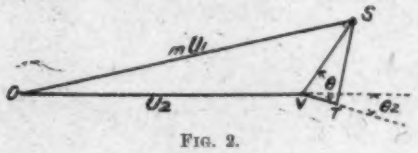

FIG. 2.

one of the coils F, and a coil mounted in series, or in parallel with the whole, or with one of the coils E. Or, yet again, the two systems E F may be so arranged that their reciprocal reactions on the currents which they induce in the disk D, yield the requisite corrective torque without the aid of a special winding.

The coils F F (fig. 1) are of different reactances, and are connected in parallel with each other and in series with one of the secondary mains. These two coils exert on the disk D a driving torque proportional to $I_2^2 \cdot \sin\alpha$, where α is the phase displacement between the currents traversing the coils. The angle α varies only with the frequency (the coils having no iron cores), hence the torque due to F F may be taken to be proportional to I_2^2. Now, since $I_2 = (I_1 - I_o)/m$ (where m = ratio of transformation on light load), the term $P_r t$ in our original formula also varies with I_2^2, and is therefore metered by the elements F F acting on D. The small error made in assuming $\sin\alpha$ to be constant is compensated by certain other assumptions made in connection with the system E E.

Fig. 1 and the preceding remarks refer to a single-phase meter, but the same principles and analogous arrangements apply to polyphase instruments. Where it is desired to meter high-tension energy supplied to several transformers, as many systems E E, F F may be employed, or single systems E E, F F may be provided, with superposed windings or multiplying relays, &c. It is, however, simpler, safer, and altogether more satisfactory to provide each transformer with an independent meter. The range of loads on the individual meters is smaller, useful data are obtained concerning the distribution of consumption between the several transformers, the risk of stoppage or imperfect operation of a meter is divided, and the extra cost of individual meters is not serious.

Meters of the new type here described need not be much more costly than ordinary low-voltage meters, since they have no additional mechanical complication except, perhaps, the second disk. The additional components are exclusively electrical, and contain no permanent magnets. There are no fresh sources of error or accident. On the contrary, the supplementary electrical components provide additional means of adjustment and compensation.

It may be objected that the meter described is not really a high-tension instrument; nor is it, in the narrow sense of these words. It does, however, meter high-tension energy, and is at least as much a high-tension meter as those at present in use with current and pressure instrument transformers. The advantages of using the robust main transformer in place of special instrument transformers are manifold. Instrument transformers are fragile, owing to their low power (compared with the high pressure for which they must be built); and they involve corrections which are, if anything, more complex and difficult than those described above.

It is possible to extend Dufour's principle of metering to measure, from any point in the low-tension secondary circuit, the energy received at any point in the high-tension circuit. So far we have arranged that the system F F (fig. 1) measured the transformer copper losses not included in the light-load losses—*i.e.*, $P_r = R_2 I_2^2 + R_1 (I_1 - I_o)^2$. We can, however, just as well adjust matters so that F F records $P_r t = [(R_2 + r_2) I_2^2 + R_1 (I_1 - I_o)^2]t$, where r_2 is the resistance of part of the external circuit of the secondary. Then the meter placed at any point in the secondary line records energy delivered at the high-tension terminals of the transformer. Conversely, the meter may be made to register the energy, corresponding to a point in the secondary line ahead of its terminals, by reducing the constant of the system F F by an amount proportional to the resistance of the circuit between the meter and the point concerned.

Similarly, if r_1 be the resistance of a certain section of the primary (high-tension) circuit, the system F F may be made to record $[(R_2 + r_2) I_2^2 + r_1 I_1^2 + R_1 (I_1 - I_o)^2]t$, *i.e.*, the energy passing a certain point on the high-tension line supplying the transformer. By applying a pair of windings F F designed and connected as above, any ordinary low-pressure meter placed at one point in a line can be made to measure the energy passing any other point (real or fictitious) in the line. One is thus able, in any case:—(1) To place the meter where most convenient from the point of view of accessibility or safety, &c., whilst still remaining strictly within the terms of the tariff in force. (2) To accept or establish tariffs based on energy received or delivered at some other point in the line than the location of the meter, even at some fictitious point in the network. This may have frequent useful application in connection with the sale or interchange of energy from network to network, and is worthy of special consideration in connection with recent linking-up schemes.

The new meter offers a cheaper substitute for equipments hitherto employed; permits even small consumers to be supplied on the basis of a "high-tension tariff," and facilitates double metering, which is always a desirable precaution where large consumers are concerned. In its various modifications, the new meter should make feasible tariffs best adjusted to the varied and numerous needs of practice.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Industrial Switchgear, and Limit Switches.

MESSRS. GEORGE ELLISON, of Wellhead Lane Works, Perry Barr, Birmingham, have developed a range of totally-enclosed industrial unit type switchgear, for D.C. and A.C. circuits up to 1,000 KW. at 750 volts, and suitable for use in factories and mines. Each unit

FIG. 1.—ELLISON 3-PANEL INDUSTRIAL SWITCHBOARD.

is self-contained, consisting of an oil breaker bolted to a steel chamber, which contains the isolating switches and bus-bars, and carries the necessary instruments, interlocking gear between the isolating switches and the breaker, and cable fittings. The units are supported by cast-iron stands, and are bolted together to form a totally-enclosed switchboard, capable of withstanding the weather

and rough usage. Fig. 1 shows a three-panel switchboard of this type, for an incoming feeder and two outgoing lines, and fig. 2 shows the interior of the bus-bar chamber, in which the bars are clamped to mica-covered steel rods. The strong construction obtained by this design enables the board to endure distortion without fracture or damage to the insulation, as when, for instance, a fall of roof in a mine has broken the stands without

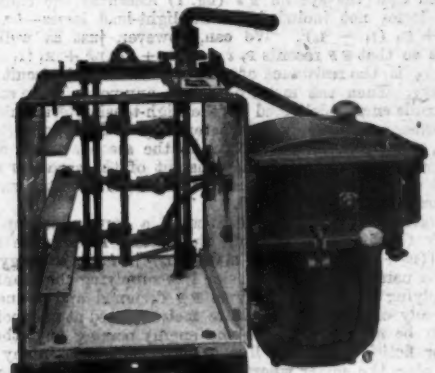

FIG. 2.—INTERIOR OF BUS-BAR CHAMBER.

interrupting the supply or necessitating costly repairs. The interlock between the isolating switches, breaker, cover, and tank is complete. A variety of control apparatus for motors can be combined with the switchgear, which is also made in several sizes.

A line of totally-enclosed self-resetting limit and emergency switches for cranes, &c., has also been introduced by Messrs. Ellison. These switches are either normally open or normally closed, according to requirements, and return automatically to the normal position after each operation, being actuated by a tappet

FIG. 3.—ELLISON LIMIT SWITCH, HAND-OPERATED (FRONT COVER REMOVED).

moving in any direction, or, if desired, by hand. Fig. 3 shows the No. 2 switch, hand-operated, with the front cover removed. The fixed contacts are large copper buttons, which may be rotated to equalise wear, and the moving contact is a substantial copper roller mounted to swivel and rotate, so as to bed on the fixed contacts; the mechanism is of double toggle type with no intermediate position, and sticking is impossible. The tappet may travel at practically any speed, and the switch may operate as often as 60 times a minute. The smaller size carries 5 amperes, and the larger 40 amperes, continuously, with large overload capacity on intermittent loads.

A New Generator of Static Electricity.

MR. W. H. CHAPMAN, of Portland, Maine, in U.S. patent No. 1,202,672, offers a remedy for loss of electrical and mechanical efficiency in static electricity generators. The invention consists in bringing a solid body of insulating material into intimate contact with a conducting liquid such as mercury which will not adhere to its surface, and then separating the solid body from the liquid and collecting from the surface of the solid the charge generated thereon. The rotating disk is partially immersed in the mercury. The inventor has found that a glass plate 8 in. (20·3 cm.) in diameter, making 80 R.P.M. and dipping into a mercury trough to a depth of 1½ in. (3·7 cm.) without induction plates will develop a potential of 9,000 volts on comb points, arranged to collect the charge at the top of the plate. The application of induction plates in proximity to the revolving plate at the point where it leaves the mercury raises the potential to 13,000 volts or more on the comb points and gives sparks ¾ in. (1·9 cm.) long. This is still further increased by covering the induction plates with a thin sheet of rubber or glass. In order to increase the quantity of electricity generated, a number of glass plates can be mounted on one shaft and separated by washers and all them dipped together into the one trough of mercury.—*Electrical World.*

A Large Arora Fire.

In spite of all the difficulties in the supply of labour and materials at the present time, we are informed that the sales of Arora fires have continued to increase, and have already doubled the output for last year, with the heavy season still to get through. The accompanying illustration shows a special fire which Mr. Robertson requested the ARORA CO., of Loughborough, to build up for the Mayor's parlour at Salford Town Hall. This has been already fixed in position and is reported to give great satisfaction

FIG. 4.—ARORA 7·5-KW. FIRE AT SALFORD TOWN HALL.

The makers have built up a special frame-work to match the existing fire-place, which is of antique brass, surrounded by tiles. The heating elements consist of ten of their standard 750-watt bars, arranged in two columns of five bars. Two separate circuits are taken to the fire, so as to balance the heating elements across the two sides of the three-wire system. Each side is worked at a pressure of 220 volts and controlled by two switches external to the fire. Probably there are few electric fires working under one frame on a 440-volt supply.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Static Electricity Phenomenon.

We think the following experience may be of interest to your readers.

One of our men working at a brewery was informed that our wires were leaking on to a boiler, and that their men were getting shocks from the valve. On examination, he found that there was no electric light in the boiler house, although some cables were carried through in steel pipes; these were earthed, and no leak was found on the wires. He came back and informed us that the packing of the boiler was charged, and we found this to be a fact.

We obtained a ½-in. spark by placing an iron rod from the packing to the valve, and the same from the packing to the top of the boiler after cuting away the packing.

There was a slight leak at a joint in a steam pipe above the boiler, and a small jet of steam played on the top of the boiler.

This we considered might be the cause, and we found it was so. On stopping this escape with a sack the discharge ceased; it returned, however, on taking the sack away. We tried this four or five times with the same result.

Perhaps some of your readers have experienced the same thing or a similar effect. The boiler is a Galloway type working at 120 lb. pressure, and is in a very confined space.

J. O. Grant & Taylor.

London, E.C., *September 13th*, 1917.

[No doubt the charge was generated by the friction of the slightly moist jet of steam on the boiler covering—the effect discovered and investigated by the late Lord Armstrong. While the combination of circumstances necessary to enable a charge to accumulate is probably very rarely met with, it is worth noting that very high potentials may be attained by the charge, and sparks may occur, which, in the presence of inflammable gases or materials, may give rise to fires or explosions the cause of which remains a mystery.—EDS. ELEC. REV.]

An Editorial Advisory Council.

Though we are far from desiring to see the British Government everywhere adopting or imitating the innovations of Allied or other Governments, we think the Premier might well take a leaf out of the book of Governor Whitman, of New York State. The Governor recently met in conference the editors of the various technical journals in the State, desiring to get reliable evidence upon questions of mechanical production, transport, coal and timber conservation, the provision of machinists and tool makers, and other vital factors essential to the successful prosecution of the war. As a result, the Governor has now a Committee of five editors acting in an advisory capacity.

Perhaps no class in the community has its fingers more completely upon the pulse of British industries than the men who so worthily and efficiently edit our Technical Press, and we feel sure they might with advantage be called in to the State Councils, where accurate information is, above all things, essential. At such a moment as this, when, to take only three important branches of public service—the air, agricultural, and marine departments—there is urgent need for the wisest and sanest counsels, as well as driving forces, we think nothing but good could come by the introduction of editorial assistance.

Barimar, Ltd.
(Scientific Welding Engineers).
C. W. BRETT,
Managing Director and General Manager.

London, W., *September 14th*, 1917.

Scale on Evaporative Condenser Tubes.

Could any of your readers inform me through the medium of your paper of some effective and expeditious method of removing hard scale deposited on the exterior of evaporative condenser tubes?

The circulating water, which is drawn from a well, contains 35° hardness, and the deposit is most difficult to remove with chipping hammers.

Central.

War Bonus for W.O. Station Engineers.

According to an advertisement in this week's REVIEW inserted by the "Northern Command," the question of a war bonus for the engineering staff is under consideration. It must have come as a great surprise to a large number of your readers that the "War Office" have, after over three years of war and high prices for food, decided to fall in line with private firms and other Government departments.

It seems, under the circumstances, that while other engineers in other power stations have been receiving from 5s. to 12s. per week war bonus, the War Office still lag behind those to whom they should show the way.

Now that a brain wave has at last reached the mighty ones, their engineering staffs all over the country will at last receive fair play (perhaps).

In one "War Office" power station of my acquaintance, certain members of the staff are receiving lower pay *now* than was paid in December, 1915.

Had Some.

Re the Fusing of an Electric Wire.

In the article headed as above in last week's ELECTRICAL REVIEW, your correspondent mentions an electric iron which had burnt ¼ in. into a table, and suggests how nearly there had been a fire. In an experience extending over 15 years, I have yet to see a single instance of an electric iron setting fire to a wood table top or wood floor, and am prepared to make a small bet that it is impossible.

Usually the trouble is discovered by the strong smell and smoke, but in one instance which came under my observation, a 200-volt 16-lb. goose iron was left on in the workroom of a lock-up shop, the iron standing on a bath brick on a 2-in. oak table; and when the shop was opened at 8.30 a.m. the following day the shop and workroom over were filled with a dense smoke (the smell lasted for weeks), and the iron was found still on. It and the brick had gone through the 2 in. of oak and left a hole large enough for two irons to go through. The brick and iron parted company on reaching the floor, the brick making a substantial mark where it settled; the iron, keeping busy, had landed exactly over a 9-in. × 3-in. joist, gone through the floor board and about 4 in. into the joist when found. The iron is still in use, and the shop is Mr. Gordon Kennett's, Oxford Road, Manchester.

The possibilities of fire being caused are very remote, provided that (I am speaking of domestic electric wiring) the gas pipes are disconnected or removed altogether. I know of a dozen instances where, due to trouble occurring in the wiring, a spark from a tube or metal sheathing to a gas pipe has burnt a small hole in the pipe, lit the gas, and as the lead was melted so the flame ran back under the floor the whole width of a room. The spark which started the trouble would not have ignited a piece of tissue paper, much less a floor board.

E. O. Walker & Co.

Manchester, *September 17th*, 1917.

STANDARD CLAUSES FOR STREET LIGHTING SPECIFICATIONS.*

In December, 1910, a Committee was appointed by the Institution to prepare a Standard Specification for Street Lighting. The Committee was subsequently enlarged by the addition of representatives of the Institution of Gas Engineers, the Institution of Municipal and County Engineers, and the Illuminating Engineering Society.

After certain preliminary clauses had been agreed upon, selected London streets were classified by municipal surveyors serving on the Committee, and photometric measurements were taken in each of them.

The results obtained were embodied in further clauses which appeared to be generally acceptable to all the members of the Committee, subject to the settlement of a fundamental difference of opinion between the gas engineers and the remaining members of the Committee as to the character of the illumination on which the specifications should be based.

The opinion of the majority was that the proper basis is to call for "minimum horizontal illumination," and this was incorporated in an interim draft for the consideration of the Councils concerned. Counter proposals that "candle power" should be the basis were received from the Institution of Gas Engineers, but the specification was substantially accepted by the Councils of the Institution of Municipal and County Engineers and of the Illuminating Engineering Society, and also by the electrical representatives on the Committee.

With the object of thoroughly ventilating the question, in the hope that some means might be found of reconciling the views of the majority with those of the minority, the specification was discussed at a general meeting of the Illuminating Engineering Society on April 15th, 1913, in the form of a paper by Mr. A. P. Trotter containing the draft.† The views there expressed were considered at subsequent meetings of the Committee, when it became evident that the two bases proposed were irreconcilable, and that unanimous adhesion to either basis would be unobtainable.

Further efforts have been made to frame such a clause as would be acceptable to the minority, but without result; and as the matter has now been under consideration for over six years, it has been decided to publish the specification as it now stands as a Majority Report. It is hoped that it may be found useful when the methods of street lighting are reviewed after the war.

In a statement by the minority of the Committee, the Council of the Institution of Gas Engineers formally express their opinion that contracts for street lighting should be based on the average candle power of light sources ascertained at two or three defined angles. This, in the opinion of the Council, is the simplest and most correct method, and, moreover, would avoid the possibility of disputes arising from the more or less uncertain measurement of minimum horizontal foot-candle values.

The standard clauses for inclusion in a specification for street lighting are printed in full in the *Journal*.

Clause 2 states that the specification is based on illumination, the unit of measurement being one foot-candle.

Clause 4, the subject of disagreement, states that the "minimum illumination" of a street means the minimum illumination on a horizontal plane at a height of 3 ft. 3 in. above the ground level, and may be measured by means of :—

(*a*) Any suitable illumination photometer, or

(*b*) Any suitable photometer adapted for use in the street which will measure the candle power of the lamps in those directions which meet at the point of minimum illumination. In this case the minimum illumination will be calculated by adding together the values of the illumination received from each lamp that materially contributes to the result.

Clause 13 includes the following definition :—

"When a minimum illumination or candle power of lighting unit is specified it shall be held that such minimum is obtained if the average of the measurements of any three minima between consecutive lighting units of the same type does not fall below it."

In an appendix a table is given, which was originally calculated by Mr. Haydn T. Harrison to show the candle power required to produce a minimum illumination of 0·01 foot-candle on a horizontal plane 3 ft. from the ground, midway between two lamps of a given height and distance apart, and which has been recalculated by Mr.

* From the *Journal* of the Institution of Electrical Engineers. Abstract.

† See ELECTRICAL REVIEW, April 25th—May 16th, 1913.

M. Wilson, of the Board of Trade, for a height of 3·28 ft. instead of 3 ft. 3 in. referred to in Clause 4, thus approximating more closely to the metre. The difference in the result, less than half of 1 per cent., is inappreciable.

WAR ITEMS.

Trading with the Enemy.—In the "London Gazette" for September 14th, further lists appear of persons and bodies in the following countries with whom trading is prohibited:—Argentina, Paraguay and Uruguay, Bolivia, Brazil, Central America, Chile, Ecuador, Greece, Morocco, Netherlands, Netherland East Indies, Norway, Peru, Spain, and Sweden.

St. Dunstan's Scheme Extended.—Sir Arthur Pearson is setting on foot a scheme for raising £250,000 for extending the splendid work that has been done at St. Dunstan's for blinded soldiers, so that a provision of 5s. per week may be made for present and future children (up to the age of 16) of these blinded heroes. Donations may be sent to Sir Arthur at 224, Great Portland Street, London, W.1, marked "Blinded Soldiers' Children Fund."

Electric Supply Restrictions in Germany.—The "Times" states that now that "summer-time" has come to an end, Germany is organising new schemes of "daylight saving" for the winter, in order to economise fuel and artificial light. Notice has been given by the General in Command of the Münster Army Corps District that the consumption of gas and electric power in shops, restaurants, and so on must this winter not exceed one-half of the consumption in the winter of 1915-16. All the military and civil authorities, businesses, and other private undertakings are required to alter their office hours, from October 1st onwards, to the time between 8 a.m. and 4 p.m. Schools will keep the same hours. The lighting of shop windows and the use of passenger lifts are forbidden, and all restaurants are to be closed at 9 p.m.

Glow Lamp Cards in Germany.—According to reports from Germany, the manufacture and sale of glow lamps are to be placed under restrictions by the Government, and the export trade in particular is to be limited. The exports are stated to be of considerable amount, and lower prices are obtained abroad than can be demanded in Germany itself. At the same time, the suspicion exists that German lamps find their way *vid* neutral to hostile countries. The business in Germany is to be regulated by the introduction of lamp cards. Since the recent establishment of a general understanding in the lamp trade prices have again been advanced by 20 per cent., and are now higher by 40 per cent. than prior to the war, wire lamps having remained the only department in the electrical industry that had been compelled through competition to adhere to pre-war prices until the new agreement was brought into operation.

The Germans in Belgium.—We are indebted to the *Ironmonger* for the following interesting paragraphs received from our contemporary's correspondent serving with the Belgian Army:—

"An enormous stock of agricultural implements, sewing machines, and other articles has been amassed at the electrical works of Dulait, at Charleroi. All this material, which has been collected in Northern France, and is locally known as the 'industrial bazaar,' makes a dump three-quarters of a mile long. It is reported that trains full of the stuff, which is first put in a state of repair, are being sent to Germany.

"As long ago as May 25th the Germans dismantled the plant of the Angleur Steelworks, and announced their intention of removing the travelling cranes. By order of the invaders, the blast furnaces of Ougrée had to stop work on May 24th, and the Germans are now dismantling the plant there also to send it to Germany. The Cockerill works at Seraing had in some measure been spared, but several hundreds of German workmen recently arrived there from Westphalia and proceeded to strip the place. Other industrial works which are reported to have been wholly or partly stripped are the Usines Boël (La Louvière), La Providence, Monceau St. Fiacre, Société de Thy le Château, Usines Métallurgiques du Hainaut, Usines Henricot, Usines de Sambre et Moselle, Aciéries de Charleroy, and Usines Bonehill (Hourpes). At these works the Germans are removing the rolling equipment (cylinders made of high-grade castings), shafting, belting, and even the foundation plates! The Germans are breaking up the big cast-iron posts to be recast. The big blowing machines of the Usines Bonehill and the Usines Boël, the four-cylinder machine of the Providence, which was exhibited at Liége International Exhibition in 1905, and the blooming-mill of the Providence Works are reported to have been converted into scrap iron."

Exemption Applications.—At Newcastle-on-Tyne Local Tribunal, on the 13th inst., Mr. E. Hatton, general manager of the Corporation tramways, asked that the cases of a large number of men, which were being reviewed by the military authorities, might be adjourned until suitable substitutes had been found for them. The Army authorities already owed the tramways 18 men to take the places of some who were with the Colours, and if more men were taken they would have to curtail the present tram service. As it was, complaints had been made by workmen in local shipyards as to the insufficient number of cars running, and the men had threatened to cease work if there was not a better service for them during the winter. It was stated that 91 tramwaymen were called up; of these 47 had entered the Army, and 20 held protection certificates. Mr. Hatton said the present system was being maintained with great difficulty, and it was impossible to put women on as drivers with the present system of brakes. As the bad weather came on, and they had more sickness to contend with, the services would have to be curtailed if he could not get men. It was suggested that an appeal might be made for auxiliary drivers under the National Service scheme, and Mr. Hatton said he had already 100 men doing auxiliary work very satisfactorily. The cases were adjourned for two months, the authorities to find suitable substitutes.

At Burnley Tribunal, last week, the Military Representative asked for the review of the exemptions granted to 14 drivers in the Corporation tramways department. Mr. Jobling asked for the cases to be adjourned so that the whole of the 90 or so exemptions to tramwaymen could be reviewed together. The Tribunal, however, heard the cases. In four cases the appeals were adjourned for re-examination, and the Military Representative's appeal was allowed in the other cases, with varying periods of grace.

Conditional exemption has been allowed to J. McDonald (32), electrical engineer, of Ramsey (Isle of Man).

At Hull, the following decisions were arrived at in appeals for Corporation tramway employés:—Driver (22, C 3), conditional exemption; car washer and motorman (37, C 1), to join up on October 1st; driver (37, general service), exemption refused; driver (23, C 1), to November 1st; driver (34, C 3), conditional exemption; driver (C 2), traffic clerk (C 3), conductor (C 3), conditional exemption.

On the appeal of Earl Amherst, exemption until December 31st has been granted to A. Kemster (38, B 2), electrician on the estate at Chevington, Sevenoaks.

At the Cheshire Appeal Court, the Chester Corporation Tramways Committee sought further exemption for the traffic inspector, the only one left. It was stated that the man understood electrical equipment, and in case of breakdowns was employed to put things right. He was granted until January 1st.

A further three months' exemption has been granted at Bromley (Kent) to A. E. H. Dussek (31, C 2), manufacturer of electrical insulating materials.

Chertsey Tribunal has refused exemption to G. T. Church (31, B 1), electrical engineer.

On a military appeal, Essex Tribunal has withdrawn conditional exemption held by J. W. Collis (30, Class A), electrician, of Leyton.

Before the County Tribunal, the Military Representative appealed against conditional exemption granted to the chief clerk in the Derby Corporation tramway offices. Appeal allowed; calling up fixed for January 1st.

At Chatham, a review was made of the cases of five members of the staff of the Tramway Co., four being motormen and the other a cashier. Conditional exemption granted in each case. Notice of appeal given by the Military Representative.

The East Surrey Traction Co. appealed at Reigate for the retention of W. P. MacAlpine (37), motor fitter and electrician, claimed to be in a certified occupation. Three months allowed.

At Reigate, exemption was sought for A. J. Pribble (39), stoker and driver at the Corporation electric light works. The engineer (Mr. Ross) stated that they now had only two drivers and two stokers, and Pribble was a skilled man. Owing to a breakdown of the Diesel engine they were now using steam power. Conditional exemption granted.

At Lye, a business appeal was made by C. H. Bromley (33, B 1), electrician, who stated that four of his staff had enlisted, one brother had been killed, and he assisted in his father's business in addition to carrying on his own. Three months conceded.

At the West Kent Appeal Court, the Military Representative appealed against conditional exemption granted locally to W. A. M. Paton (19, A 1), engineer in the electric light department of Gillingham T.C. The appeal was assented to, and six weeks' exemption substituted.

At Bermondsey, Messrs. W. & R. Jacobs, manufacturers of electrical apparatus, applied for the exemption of a man in charge of their warehouse and staff, 34 years of age, single, passed as fit for garrison duty at home. The claim was disallowed, not to be called up before October 17th.

At Southwark, the Military Representative said he had received the latest instructions with reference to men holding certificates of exemption under the protected trades schedule, which were that he was not to oppose any application to the Tribunal for the exemption of a man who had his protection certificate withdrawn, so long as the application was made within seven days after he had received his calling-up notice to join the Army.

REVIEWS.

Practical Costing. By Arthur H. Gledhill, A.M.I.M.E. London: The Gledhill-Brook Time Recorders, Ltd. Price 3s. net.

The author deals with the subject in a thoroughly comprehensive manner, and covers the ground from "Alpha to Omega." The system advocated so far as labour is concerned is automatic time-recording, and the "Clipper" time recorder is the medium. This instrument must not be confused with the ordinary "in" and "out" recorder, but is so designed as to record job costing, repetition work, repair work, &c.

In the introduction the author gives a number of essential points which should be carefully considered when starting a new costing system, amongst which he states truly: (1) That different classes of work require different costing systems. (2) The costing system should be arranged to give a maximum of detail information with a minimum of clerical labour and expense. (3) The workman is the wrong person to enter the time records. (4) That it is more efficient and less costly to put the work in the hands of a cost clerk with the aid of a time-recording clock for printing the actual times to the exact minute when jobs are commenced, finished, or broken off. The diagram, "Building up of a Selling Price," shows clearly manufacturing costs, &c., including unproductive labour costs—which is a most important item—giving each cost as a percentage of the whole.

Chapter I details clearly the routine necessary to start a job. The author analyses to a degree, and his dissection to a point may be unnecessary, but he shows how, if required, costing can be detailed minutely. The works orders first set in motion at the commercial end are very clearly illustrated. One portion, however, is not by any means clear. The author states: "To firms who have always worked hand to mouth, this method would probably occasion a stoppage of output for a few months, but those who have made the change agree that the increased output afterwards secured has amply repaid them." The reviewer cannot for one moment see how the adoption of any new method should have the result the author states. If an existing system is brought up to the end of any period it is simply a question of managerial control to put into operation a new system. No doubt, for a few weeks the management would have to pay particular attention to the method of operation, and it might necessitate the costing clerks having to make a few early-morning starts. It brings to the reviewer's mind the following few lines:—

"It Couldn't be Done."

"Somebody scoffed, 'Oh, you'll never do that,
At least no one ever has done it';
But he took off his coat and he took off his hat,
And the first thing he knew he'd begun it.
With a lift of his chin and a bit of a grin,
Without any doubting or quiddit,
He started to sing as he tackled the thing
That couldn't be done—and he did it."

Chapter II is devoted to time records, showing different systems.

Chapter III deals with general labour costs, and touches upon unproductive labour cost. The reviewer is pleased to see the importance the author attaches to this item in this and subsequent chapters. In the reviewer's opinion there are too many cases where this particular factor is dealt with in a slip-shod manner, labour *recorded* on the job, machine hours, material, and managerial charges, &c., going to make up the cost. As a matter of fact, unproductive labour may be looked upon as stand-by labour; it certainly has to be paid for, and is thus a direct charge upon all output; moreover, it is a factor, if truly recorded, which indicates how far it is possible to increase output without additional labour costs, machine hours and raw material being additional, but no increase is incurred in managerial charges or capital.

Chapter IV deals with hourly machine rates, giving examples of how to arrive at them, and dealing with running time, idle time, productive hours, &c. What the reviewer stated about unproductive labour records applies practically to unproductive machine hours, depreciation, interest, floor space, rents, rates, taxes, &c., being a direct charge, even when the machines are idle; therefore all costs should bear a proportion of this charge. Chapter IV, "Hourly Rates for Labour," shows very clearly the fallacy of flat-rate overhead charge on labour, and gives a very interesting hypothetical basis for fixing hourly rates.

Chapter V, "Stores and Materials," gives briefly the method of dealing with this important department. The author could in this case have augmented the information to some advantage if he had dealt with the method in detail from the receipt of the raw material to the collection and assembly of finished parts.

Chapter VI, "Overhead Manufacturing Expenses." This chapter, coupled with the illustration, is very concise indeed.

Chapters VII and VIII, "Selling Expenses" and "Final Summaries of Costs," are clearly set forth in a very interesting manner, and the illustration showing periodical average costs is well worthy of study and consideration.

Chapter IX is on "Balancing Cost Accounts and Commercial Accounts." This is a most important item, and, briefly, means that for every item of expenditure, unproductive labour, recovery of hourly rates, &c., a corresponding charge is made somewhere or other. The illustrations showing total sales compared with material, wages, productive and unproductive, other expenses, and profit are self-explanatory.

Chapter X, "Weekly Department Report," gives a very interesting summary of expenditure.

Chapter XI, "Manufacturing in Multiples of 60," contains something new and worth some little consideration, the calculation of the factors quantity and time being reduced to a minimum, thus:—

60 articles made in 14.75 hours = 14.75 minutes per piece.
600 articles made in 14.75 hours = 1.475 minutes per piece.
30 articles made in 14.75 hours = 29.5 minutes per piece.
300 articles made in 14.75 hours = 2.95 minutes per piece.
And so on.

The concluding chapters, "Costs and Estimates," "Bonuses for Increased Output," "Dead Charges," &c., are dealt with in a very lucid manner, and the illustrations, showing a series of standing order number job cards printed on coloured cards, also production job cards and a weekly time card ruled on the back for analysis of jobs worked upon each week, and the labour cost of each, make the subject very clear.

In conclusion, the reviewer can recommend this book to all those interested in manufacturing costs, irrespective of whether their existing system depends on clock recording instruments or otherwise, as the author has dealt with this subject both theoretically and practically.—J. C. P.

How to Lay-out Turret Lathe Tools. By Alfred Herbert, Ltd. Coventry: Alfred Herbert, Ltd. Price 2s. 6d.

Though somewhat in the nature of a trade publication, this handbook "for those who design tools for use on turret and capstan lathes and automatic turning machines" constitutes a decidedly useful addition to the literature on the subject.

Very few firms engaged on munition work are now manufacturing without machine tools of this type, of which vast numbers have been built or imported since the commencement of the war. The laying-out of such tools is a highly skilled job, but many workers are being called upon to tackle it with little more than an average shop experience. To such the present work cannot fail to be of value. Even the expert will find in it some useful hints, and valuable suggestions will be received as a result of a careful study of the 115 reproductions of photographs and drawings that the volume contains. Various typical lay-outs are described, *e.g.*, the tools actually used on gun-metal fuse adapters, aeroplane propeller bosses, and motor-car flywheels.

The author wisely insists on the importance of lay-outs being as simple as possible, and embodying standard tools and holders. "Ingenious" tools are usually a poor economy.—G. S. S.

Underground Transmission and Distribution for Electric Light and Power. By E. B. Meyer. London: Hill Publishing Co. Price 12s. 6d. net.

The manufacture and laying of underground cables is a specialised branch of electrical engineering which involves very large expenditure. As compared with other branches of electrical engineering the literature is scanty, but this book goes far to fill the gap.

The subject matter is mainly treated from the American view-point, but there is also a good deal of information concerning standard practice in Europe.

After describing various forms of duct, the author states that tile and fibre conduits are now used almost *universally*, by which he means in U.S.A.

The first is made from vitrified clay, and when free from iron has high insulation, giving an average puncture test of 25,000 volts dry and 21,000 volts after immersion in water for several days.

Fibre conduit has been in use for about 15 years, and some that the author had occasion to examine after it had been in moist soil for 10 years showed no signs of deterioration. It is made of wood pulp which has been thoroughly saturated with a bituminous compound containing about 6 per cent. of creosote. The latter prevents rotting by killing organisms which might act on vegetable matter in the pulp. It will stand a puncture test of 32,000 volts dry, and 24,000 volts after immersion in water for about 200 hours. It is made in 5-ft. lengths, which are convenient for transport and handling in the trenches. The ducts are laid in concrete, about one inch being left between adjacent ducts.

In reference to armoured cable, the author says that in Europe this class of cable is practically standard for all underground systems. What he refers to as a *large* installation is in Central Park, N.Y. City, where 500,000 ft. of steel-tape street-lighting armoured cable has been laid.

Rubber, paper, varnished cambric, and other forms of insulation are described, and under the heading "Graded Insulation," the author says:—"The potential gradient of insulated wire is much higher in that portion near the conductor than in the outer layers, and the fall of potential

across a series of insulators of varying specific inductive capacity is inversely proportional to those capacities." By taking advantage of this law, a smaller diameter of cable may be used with the same factor of safety.

Under the heading of "Lead," reference is made to the lead-boring insect found in Australia and in the south-eastern portion of U.S.A.; also to the fact that slight traces of arsenic, antimony, copper, tin, &c., in lead are a benefit rather than an objection, as they tend to slightly harden the metal.

Owing to the fact that alternating current in large cables has greater density on the surface, it has been found advisable on single-conductor cables of large area to strand the copper wires on to a central fibre core.

Sector cables are described, and it is pointed out that a larger portion of the periphery of each conductor is nearer the lead sheath than in an equivalent round conductor. This allows a greater radiation, with consequent higher current density.

The chapter on installation of cables is good, many quite small, but necessary, details being illustrated and described —for example, basket wire-grips and flexible duct cleaners.

From one figure it is a little surprising to find that the cities of Milwaukee, Newark, Boston, Detroit, New York, San Francisco, Chicago, and Brooklyn have each their own particular methods of drawing in cables, and the differences are quite appreciable. Jointing is, of course, dealt with.

A good tip that is mentioned, is the practice of a company in the States of "putting up" all the materials for a cable joint in unit packages. The author thoughtfully gives a picture of the contents of such a package.

There is some original information on cooling of duct lines, and it appears that the Niagara Falls Power Co. cools its underground cables by circulating water through vacant ducts adjacent to occupied ducts. At Baltimore it was found that cable burn-outs were more frequent in summer. Therefore, in 1915, a sprinkler system was installed to keep the ground moist where the burn-outs mostly occurred. The results at the time of writing are said to be interesting, but not conclusive.

The cooling of underground transformers is referred to in the chapter on distributing systems, and the author says that 8 watts of transformer losses may be allowed per sq. ft. of wall space. In moist soil, with ventilated chamber, 12 watts may be allowed. In wall surface he includes the roof and floor.

Current-limiting reactances are described, and it is stated that they should be of the air-core type, and their capacity correspond to the full-load capacity of the line which they are intended to protect. They are generally built in with wood and concrete or porcelain.

Seven pages deal with selective fault-localiser, arcing ground suppressor, grounded neutral systems, and the Merz system of cable protection.

Electrolysis has a chapter to itself, and it is admitted that when this began to be serious American engineers did not have as thorough a grasp of the situation as did engineers in Europe. American practice has not sought to remove the underlying causes of electrolysis, but has attempted merely to relieve acute conditions. The measures adopted in addition to track bonding, have consisted of "pipe drainage" or bonds to other systems.

The author states that the usual method of protecting cable sheaths is by use of a drainage system similar to that used for the protection of pipe lines. The object of draining the sheaths is to make them slightly lower in potential than the surrounding earth or neighbouring structures, thus preventing current *flowing off* the sheaths. Since there is danger of over-draining in making the sheath potential considerably lower than that of the ground or adjacent grounded structures, it is sometimes necessary to insert suitable resistances in the drainage leads.

As with nearly all the books of the Hill Publishing Co., numerous specifications are interpolated in the text. Also, a good deal of information is given as to construction costs, &c. Occasional references are made to papers in which further information on a particular point may be found.—E.K.S.

High-Speed Internal-Combustion Engines. By Arthur W. Judge, Wh.Sc., A.R.C.Sc. London: Whittaker & Co. Price 15s. net.

It might be thought that the work of describing the internal-combustion engine had almost become one of supererogation, so many are the authors who have given us books upon this subject. But few of them deal fully with the high-speed side of the subject, generally confining themselves to the heavier, slow-speed types of engine. Of course, the high-speed engine is now of the utmost importance in these days of motor cars and aeroplanes, hence Mr. Judge's justification in enlarging upon the subject. He deals with the question chiefly from the theoretical side, but also gives many experimental data, especially where experimental work has influenced design. The data are not necessarily always original; often they have been brought together from widely scattered sources. In fact, to some extent, the volume under review constitutes a compendium of the literature on the subject, and the author is to be congratulated on the thoroughness of his classification. He skilfully analyses and presents in order and sequence the more important of the available theoretical and experimental results.

A practical point that emerges from his consideration of the question of pressures and temperature relates to the use of alternative fuels to petrol—a matter very much to the front at the present time. He shows that though in benzole, paraffin, and in alcohol we have excellent petrol substitutes, efficient use of these liquids cannot be made with existing engines. They must be redesigned if they are to give the best results. The need for this will be seen from Mr. Judge's statement that "the compression pressures required for the best results with paraffin as a fuel are about 75 to 85 per cent. of those of petrol, whilst with benzole compression pressures of 110 to 120 per cent. of those used in petrol engines are necessary for higher mean pressures to be realised." Alcohol, he shows, works most satisfactorily with compression pressures "varying from 150 to 200 lb. per sq. in." Since these compression pressures are about 100 per cent. greater than those employed in petrol engines, we can readily admit that special alcohol engines will be needed in the future if the best results are to be obtained from a fuel that there is reason to suppose will be very much to the fore after the war.—G. S. S.

BUSINESS NOTES.

Feed-Water Regulators.—Messrs. Scholey & Co., Ltd., inform us that their Copes feed-water regulator, which we described some time ago, has been very largely adopted by steam users, whose experience of its use, judging by the reports of prominent engineers, has been very satisfactory indeed. The importance of maintaining a constant water level has not been fully appreciated in the past, but, in reality, a good feed-water regulator plays a part in relation to a boiler analogous to that of the governor of an engine, and prolongs the life of the boiler and pumps by preventing sudden changes of temperature and load due to irregular feeding.

Fire.—The workshops of Messrs. Gilbert Bros., electrical engineers, Navan, Co. Meath, containing a quantity of electrical fittings, was destroyed by fire on Friday morning last. The firm's plant was saved.

German Industrial Activity in Spain.—At the beginning of 1914 it may be said that Spain languished, and, excepting some industrial activity in Catalonia (Barcelona) and Guascogna (Bilbao), there was nothing in the rest of the country to call for interest. The war has awoke the slumbering energy, and under the stress of necessity, individual and collective, here a little and there a little, but leisurely, led to the realisation of some progress. In 1913, Spain exported iron and steel goods to the value of a million and a-half pesetas; in 1916 these figures had risen to 57 millions. In copper the advance was from 8 to 21; firearms from 10 to 25; chemical products from 5 to 28; woven cottons from 3 to 28; textiles, 33 to 68; leather and skins, 2 to 31; machinery and railway plant, 4 to 17. Taking account of the increase in prices, there is here an indication of the multiplication of the capacity of production which affords the most eloquent explanation of the fact that in 1916 new companies were founded with a total capital of 230 million pesetas. It is certain that many of these were promoted by Germans, and with German capital, for it cannot be denied that, notwithstanding the war and the blockade, Germany has completed every step to continue its business operations with the whole world, making use of countries now neutral. Another awakening which may have its own importance is that of the mining industry. Spain is rich in mineral deposits, has abundant labour and cheap. She is richer, perhaps, than Italy in water resources, and has good coalfields. According to approximate calculations, Spain might avail herself of 6,000,000 H.P. of electric energy, of which to-day she only makes use of 80,000 H.P., notwithstanding that concessions have been granted for 1,000,000 H.P. The Government has taken important measures to foster the industrial development of the country. New industries can enjoy the help of the State, which is specially shown by fiscal advantages and exceptions, by concessions and privileges from State or State-supported banks, by State grants and loans at low interest, and by State guarantees of a minimum interest on capital invested. Moreover, the industries already existing may avail themselves of like advantages by turning out ships of over 10,000 tons burden or colliers, or occupy themselves with the extraction and treatment of iron, copper, zinc, or the cultivation of the products of the ground and the manufacture of chemical manures and agricultural machinery. Similar, and even greater, facilities are accorded the hydro-electric works of 1,000 H.P. and above, the chemical industry (chiefly colouring materials), and the manufacture of electrical plant and scientific apparatus. The wealth created in Spain by the war, the expansion of its industries, the not negligible help of the Government, and the competition of the German invasion with industrial productions with a Spanish label, will carry Spain forward for a number of years to a higher industrial level than might have been expected, making of her a possible competitor with other neighbouring countries, like Italy, but also an available market for their products as also a good field for action for their electrical engineering talent.—*L'Elettrotecnica.*

For Sale.—Rhondda U.D.C. invites tenders for the purchase of a complete up-to-date private generating plant, recently installed by the Westinghouse Co. For particulars see our advertising pages.

Technical Advertising.—In the September issue of *Cheap Steam*, Messrs. E. Bennis & Co.'s magazine, there is an entertaining article on "The Troubles of an Ad-Man," by Charles Brangwyn. In the course of the contribution the writer says :—

"In the face of facts which scream at him from every turn, the technical man—and the salesman, too—often looks upon advertising as an expensive fad, a luxury, or something worse, but always a superfluity. Not that he will always say so in words, for back of his mind he has a feeling that to do so would expose him to ridicule. 'Of course, we must do a little,' he will, perhaps, admit regretfully, but he doesn't *believe* in it. There is no faith behind his admission.

"Grant him that no advertisement ever of itself sold a steam turbine or a mechanical stoker, but what would the world know of any commodity without advertising? The advertisement is at work when the salesman is at rest, preparing the mind of the prospect as he sits by his own fireside where no salesman ever penetrates, it is talking to him in his office even while the traveller is being told 'too busy to see you this morning.' It is ever smoothing out the stony ground over which the salesman may afterwards travel with ease, impressing the name of the firm and the merits of its manufactures on the mind, so that at the moment of his need the buyer involuntarily thinks of the firm whose advertisement he has most often seen."

Book Notices.—*Useful Engineers' Constants for the Slide Rule.* Second Edition. Glasgow : J. A. Burns. Price 1s. net.—This little book is intended to show how the slide rule may be used to the best advantage by the practical engineer in technical or commercial calculations, with special reference to the use of special constants for repetition work on the rule. After a brief explanation of the ordinary slide rule, the author illustrates its application to a variety of mechanical, electrical, and hydraulic calculations, his object being rather to assist the reader in working out time-saving constants for his own use than to compile a large number of examples. A few tables of weights and measures, conversion tables, &c., are appended ; in some of these, we think, the author errs by giving values running, in some cases, to as many as eight significant figures, where four would suffice for the slide rule (and for almost all practical purposes). It is a useful little work, very lucid, and admirably arranged and printed.

"Science Abstracts, A and B." Vol. XX, Part 8. August 30th, 1917. London : E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Practical Electric Illumination." By T. Croft. London : Hill Publishing Co. Price 8s. 4d. net.

"Wayleaves." By C. Vernier, M.I.E.E. Reprint from the *Journal* of the Institution of Electrical Engineers, with discussion. From the author.

C.C. Motors and Control Apparatus. A new text-book with this title has just been published by Messrs. Whittaker & Co., the author being Mr. W. Perren Maycock, M.I.E.E. The work comprises 330 crown 8vo. pages, and has about 150 illustrations and diagrams. In its writing, Mr. Maycock has had the assistance of Mr. E. Hughes, B.Sc. (Lond.), of the Heriot-Watt College, Edinburgh.

We have received a folder relating to Messrs. A. P. Lundberg and Sons' examinations in electric light switching, and containing extracts from letters showing the keen interest with which men on Active Service, as well as in civilian life, regard these exercises.

"*Proceedings* of the Incorporated Municipal Electrical Association, 1917." London : Wyman & Sons. Price 5s.

Trade Announcement.—In order to centralise their business, the Stanton Ironworks Co., Ltd., are removing their office, on October 1st, from 44, Coal Exchange, E.C. 3, to Maxwell House, Arundel Street, Strand, W.C. 2. New telegraphic address, "Cobbles Eaststrand London" ; telephone number, "Central 6808." Mr. Arnold Longden, who has represented the company for some years on the London Coal Exchange, will continue to supervise the company's interests at Maxwell House,

Catalogues and Lists.—Messrs. Scholey & Co., Ltd., 56, Victoria Street, London, S.W. 1.—Pamphlet giving illustrated description of the Copes feed water regulators.

Overseas Engineering Co., Ltd., 75, Curtain Road, London, E.C. 2.—Two circulars giving description, prices, &c., of their "Overseas" self-contained electric lighting plants.

Aluminium Works in Austria.—It is reported from Vienna that the Hungarian Natural Gas Co. (Erdgas Gesellschaft) proposes to establish an aluminium factory for the purpose of working up the bauxite deposits which are said to be situated in the vicinity of the company's natural gas mines in Transylvania. A new aluminium works is also projected in the neighbourhood of Innsbruck, whilst three other schemes for similar works are proposed in connection with the utilisation of Alpine waterfalls.

LIGHTING AND POWER NOTES.

Accrington.—Year's Working.—The annual statement of accounts of the Corporation electricity department shows gross revenue £35,775, expenditure £34,064, leaving a gross profit of £1,711, which, with interest on investment, totals £1,735 ; capital and income-tax charges, &c., amounted to £11,242, and special charges to £647, leaving a deficit on the year's working of £10,154. To this must be added the deficit balance brought forward, making a total deficit balance at March 31st last of £14,521. As compared with the previous year, the costs of generation, &c., increased by more than £8,000, due to the extra price of coal and labour. Total units sold 7,180,755, as against 6,734,932 in 1915-16 ; average price obtained per unit sold, 1·10d. ; works cost per unit sold, 1·14d. ; total all-in costs per unit sold, 1·516d.

At a meeting, last week, of the Accrington and District Trades and Labour Council, a resolution was moved on behalf of the Steam Engine Makers' Union, requesting the B. of T. to inquire into the working of the Corporation electricity works, with the object of presenting a report to the burgesses, and of assisting the Corporation officials to place the undertaking in a better financial position. The resolution was agreed to.

Alva.—The Town Council is co-operating with the leading manufacturers in the town with a view to having electric power introduced.

Batley.—War Bonus.—A Special Sub-Committee of the T.C., after consideration of an application by the Corporation employés for an advance in war bonus, has decided to recommend an all-round increase, bringing the bonus up to 10s. per week.

Buxton.—Price Increase.—The T.C. has decided upon a war-time increase of 20 per cent. in the charges for electricity to all consumers, from the end of the current quarter.

Carlisle.—Price Increase.—The City Council has decided that the charges for electricity shall be increased by 10 per cent. from October 1st, except in cases covered by special agreements.

Continental.—Spain.—The Sociedad Hidroelectrica de Pindo has recently secured a concession to establish a plant to utilise the water power of the River Dobra, in the Augon Valley (Province of Oviedo), in the generation of electrical energy for power purposes.

Dewsbury.—Lighting Restrictions.—The local Chamber of Trade last week decided to urge upon the West Riding authorities that 7 p.m. should be definitely fixed as the time for shop-lighting restrictions throughout the winter, or, in the alternative, that a definite uniform time should be fixed for the different months. It was held that there would be no need for obscuring lights at all if satisfactory arrangements could be made for extinguishing them promptly if necessary, and a Sub-Committee was appointed to interview the Chief Constable of the town to see if better shop-lighting facilities could be arranged.

Doncaster.—Strike Notice.—With further reference to the paragraph on p. 253 of our issue of September 14th, the Corporation was at first inclined to take no action, but it was announced last week that the matter, which had been referred to the Committee on Production, would come before an arbitrator on Friday, September 14th, and consequently the employés—those concerned number nearly 300—suspended their notices pending the result.

Harrogate.—Street Lighting.—The acting chief constable of the West Riding has sanctioned the lighting of a number of electric street lamps in the town, leaving the question of a possible further number in abeyance. The local Lighting Committee has decided that these lamps shall remain lighted throughout the night as from September 6th.

Hove.—Year's Working.—The statement of accounts of the Council's electricity undertaking for the year ended March 31st shows receipts £23,487, expenditure £11,573, and gross profit £11,914, which, with income-tax refunded, totals £12,081. Interest, sinking fund, and income-tax charges, &c., absorbed £11,336, leaving a net balance on the year's working of £745. On the Aldrington section the revenue account shows income £2,236, expenditure £1,423, gross profit £813 ; loan charges, &c., absorb £687, leaving a credit balance of £126.—*Sussex Daily News.*

The Electricity Committee places on record its appreciation of the able manner in which Mr. C. B. Smith has managed and carried on the undertaking during the war under most difficult circumstances.

Keighley.—Price Increase.—At the T.C. meeting, last week, the Electricity Committee recommended that in future sealed agreements for electricity supply entered into by the Corporation the price per unit be increased, as follows :—D.C. system (minimum annual payment £40), from ·8d. to ·875d. per unit ; three-phase high-pressure system, from ·3d. to ·375d. ; the present charge of £3 per kw. of maximum demand to continue. Mr. Sellers, moving the adoption of the Committee's accounts, said that the department's output had doubled since the beginning of the war, and coping with doubled business under war conditions was no light task. The lighting restrictions had caused a falling-off in units. Last year £5,612 had been paid out of revenue for repayment of capital, whilst the interest on loan charges had amounted to £3,194. The average price obtained for the whole supply had been ·85d. per unit, which was ·01d. less than last year ; this was due to the larger output being given for power uses, whilst lighting units had shown a reduction. There was a net profit of £223.

Kilmarnock.—Proposed Loan.—The T.C. is applying to the Scottish Office for power to borrow £80,000 for electricity purposes.

Launceston.—Suggested Price Increase.—The Electric Supply Co., Ltd., has applied to the B. of T. for consent to increase the price of electricity for lighting from 6d. to 8d. per

unit, and for power and heating from 3d. to 4d. The directors have promised the consumers not to raise the price beyond 7d. unless special circumstances warrant it, and to consult the consumers before increasing the charges beyond 7d.

Leeds.—Shop Lighting.—The Leeds Chamber of Trade last week unanimously decided to urge the Home Office to appoint a definite time for subduing shop lights during each month of the autumn and winter, in order to avoid the lack of uniformity and consequent trouble both to shopkeepers and authorities, which was experienced last winter.

Lye.—Street Lighting.—The U.D.C. has decided to give the gas company six months' notice to terminate the public lighting contract, the idea being to substitute electricity.

London.—St. Pancras.—Year's Working.—The accounts of the electricity undertaking for the year ended March 31st last show a net profit for the year of £26,828. In anticipation of this balance, £5,000 was transferred in aid of the rates for the current half-year, and the Finance Committee holds that a further sum of £14,000 should be used during the ensuing half-year to meet the lighting portion of the Council's requirements, and to relieve the rates. This will leave a credit balance on the electricity revenue account of £7,828. The Electricity Committee considers that the increase in the price of electricity of 10 per cent. made at the June quarter, 1915, should be reduced to 2½ per cent., and that the resolution of the Council of June, 1916, respecting meter rents being charged on a sliding scale should be rescinded. It is estimated that these concessions will affect the revenue for the current financial year by about £8,000 in respect of the six winter months, during which the alteration will be in operation, and in subsequent full years by about £12,000 per annum.

Poplar.—Year's Working.—The annual report of the electrical engineer and manager, Mr. J. H. Bowden, shows that the energy sold amounted to 23,477,042 units, an increase of 1,970,428 units, or 9 per cent.; the net income from the sale of energy amounted to £103,878, an increase of 17½ per cent., and the working expenditure was £67,069, an increase of 28½ per cent. The gross profit was £36,808, an increase of £497 on the previous year; and, after deducting interest £11,382, repayment of loans £13,143, and sundry charges £899, there remains a surplus of £12,011, a slight increase over 1916. With the unappropriated balance of £8,596, there was a total surplus of £20,607; a sum of £3,393 was transferred to the rates, about £9,000 was applied to items of capital expenditure, alterations, &c., £1,262 to the staff as a bonus, and £686 was transferred to the superannuation and pension fund, leaving an unappropriated balance of £6,137 to be carried forward. The average price of coal rose from 17s. 11½d. per ton in the previous year to 20s. 5d., a difference of 2s. 5½d. per ton, which on a consumption of 37,247 tons is equal to £4,578; works costs rose from 0·58d. to 0·69d.; the average price obtained per unit sold was 1·062d., and if the bulk supply is deducted the price for energy sold in the Poplar area becomes 1·194d. The capital employed per kw. of plant installed is £32·4; the load factor was 30·11 per cent. compared with 30·2 per cent. in the previous year. The sale of energy for private lighting was 1,210,334 units, for domestic supply 935,414, for power 17,832,739, for bulk supply 3,294,711, and for public lighting 203,644 units.

Pinner.—New Mains.—The Electric Light Co. has informed the Hendon R.D.C. that it intends to lay mains in various parts of the district.

Portsmouth.—Year's Working.—The accounts of the Corporation electricity department to March 31st last show total revenue £53,301, an increase of £2,696; works costs £40,445, an increase of £4,625; gross profit £12,856, as compared with £14,784. Repayment and loan charges amount to £21,110, and income-tax and special charges to £854, making a total of £21,964, leaving a deficit on the year's working of £9,108, which has been taken from the reserve. The reserve fund now stands at £10,789. The cost of coal per unit generated has increased since the war began from '66d. to 1·65d., and the total works cost from 1·4d. to 2·6d. Total capital expenditure to date, £375,427; amount repaid, £225,744; amount outstanding, £149,683.

Salford.—Street Lighting.—The Lighting Committee proposes to make arrangements with the Electricity and Tramways Committee of the borough for the better lighting of the streets during the coming winter. It is intended to have a number of electric lamps, shaded from above, and suspended from the cross wires between the tramway standards. These lamps could be easily extinguished in the event of a warning.

Southend-on-Sea.—Slot Meters.—With reference to a decision of the Electricity Committee that consumers of electricity through slot meters should be required to pay a minimum of 18s. per annum, the borough accountant has been instructed to require payment of a deposit of 15s. from all persons using slot meters who have not, during the last 12 months, consumed energy to the value of 18s., and that on and after October 1st it be a condition precedent to the hiring of slot meters that a deposit of 15s. be paid. The L.G.B. is to hold an inquiry into the application of the Council for sanction to borrow £45,520 for the provision of additional generating plant at the electricity works at the termination of the war.

Southport.—Wages and Salaries.—The Corporation Electricity Committee has decided to increase the wages of the stokers from 4s. 8d. to 5s. 8d. per shift, and of the drivers from 4s. 8d. to 5s. 10d., exclusive of war bonus. It has been decided to increase the salaries of the track superintendent, the mains superintendent, the two engineers in charge, and the chief clerk, these officials, it is stated, having had no increase for 10 years.

Weymouth.—Year's Working.—The statement of accounts of the electricity department for the year ended March 31st last shows gross receipts £12,725, and expenditure £9,397, leaving a gross profit of £3,328; after making provision for repayment and interest charges of £4,393, there is a deficit on the year's working of £1,065; total capital liability £67,164, of which £23,719 has been repaid, leaving £43,444 outstanding. The Electricity Committee hopes that as the increased charges did not operate for the whole of the year, the augmentation of revenue during the present year may have further beneficial results. Units sold, 926,918; maximum load, 500 kw.; load factor, 21·16 per cent.

TRAMWAY AND RAILWAY NOTES.

Argentina.—According to a Buenos Aires telegram, the tramway employés at Rosario have gone on strike. Many of the tramcars have been set on fire.

Blackburn.—Wages.—The Corporation Tramways Committee, last week, considered an application from the Lancashire and Cheshire District Council of the Amalgamated Association of Tramway Workers for an additional increase in wages of 7s. 6d. a week for all tramway workers (male and female) over 18 years of age, and 3s. 3d. per week for all under that age. It was decided to allow the matter to go to arbitration.

Bradford.—Tramcar Lighting.—In view of the proposed improved street lighting during the coming winter, efforts are being made to obtain better tramcar lighting also. The matter has been taken before the authorities concerned, but has not yet been settled.

Continental.—Spain.—The constructional works have been started of the electric railway from Santa Coloma de Farnés to Sils, which the company of the same name has in hand. The line is important as being the first stage in a network 245 km. in extent, which is destined to cover a great part of the province of Catalana. The network will cross the provinces of Barcelona and Gerona from Manoesa, on the shores of the Levant, to Maya, Vich, San Hilario, Santa Coloma, Sils, and Llagostera, with branches to the most important population centres of these territories, which will be linked together by three main and two secondary railway services. The network will open up the rich forest and mineral regions of Las Guilleras, and bring life and movement to communities, many of which are now shut out from outside communication.—*Industria e Invenciones.*

Application has been made for a concession for the construction and working of an electric tramway in Guadalajara between the railway station and the centre of the town.

Germany.—It is reported from Krefeld that the German War Office has decided to stop the tramway service and place the tramway material at the disposal of the army. Similar measures are contemplated in other industrial centres in Western Germany.

Droylsden.—Fares.—At a meeting of the D.C. held last week, a protest was raised against the increased fares between Droylsden and Ashton-under-Lyne on the Manchester to Ashton system. From Droylsden to Ashton the fare is 2½d., and from Droylsden to Manchester, nearly three times the distance, it is only 1½d.

Farnworth.—Through Running.—A working arrangement has been arrived at between the Bolton Corporation and the South Lancashire Tramways Co. whereby cars now run through from the Black Horse, Farnworth, to the terminus at Bolton, only one ticket instead of two being issued.

Liverpool—Southport Railway.—Stoppage.—A breakdown on the Liverpool-Southport Electric Railway line on Friday morning, last week, caused considerable delay to business men and visitors. As one of the electric trains was travelling between Seaforth and Liverpool something went wrong with the motors, and the train stopped, blocking the line. Eventually a steam locomotive was requisitioned, but the service was interrupted for the better part of an hour.

London.—Collision.—A collision occurred between two L.C.C. tramcars, on Sunday evening last, and resulted in 12 persons being injured. A tramcar standing at the junction of New North Road and Essex Road was run into by one coming from the north, owing to the failure of the brakes to act, the front of the runaway car being completely smashed; the injured were treated at the local hospitals, but none were detained except the driver of the runaway car, who was rather severely injured.

Rawtenstall.—Strike Settled.—The trouble on the Corporation tramways, which resulted in a five days' strike on the part of the employés, has been settled. The dispute arose because the male workers were offered a war bonus of 4s. a week and the females one of 2s. 6d., to date from September 1st, and the employés wanted a 4s. bonus all round, to date from July 1st. The Town Council has now agreed to the all-round bonus of 4s., but it is to date from September 1st, and the employés have accepted the offer.

South Africa.—Bloemfontein.—In connection with the railless tramway service the Town Council has decided to employ tractors in order to cope with the traffic on certain routes. As an experiment, an order for one tractor has been placed with the Griffin Engineering Co., of Johannesburg.

Wallasey.—Strike.—The Corporation tramway drivers and conductors came out on strike on Wednesday last, after giving 48 hours' notice of their intention, failing an undertaking from the Tramways Committee to cease training women as drivers. The employés' contention that the object of training women as drivers was to displace men and to release more men for the Army, was met by the assurance of Colonel R. R. Greene, the general manager, that women employed as drivers would receive the same wages as men. Although it was further pointed out that such a strike was illegal, both men and women came out. A curtailed service was run with the help of the office staff, 15 cars being out against the usual 45, and considerable inconvenience was caused to business people. On Thursday, however, the strike collapsed, the employés returning to work on the understanding that their grievances would be considered by the Committee.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—The Government has withdrawn the permission granted to a German wireless telegraph company to make experiments with a view to recording the wireless communications sent out from Nauen, the big wireless telegraph station near Berlin.

The New York *World* publishes a dispatch from Buenos Ayres revealing the existence of a vast German spy system in Argentina, and disclosing the bureau which directed all espionage in South America. A secret wireless apparatus was discovered, and messages concerning ships were traced. The Argentine Government has proof that Germans collected facts relative to the departure of cargoes and the destination of vessels, the place of embarkation of troops, and the movements of neutral ships. The dispatch says that German spies in Argentina were in direct communication with Berlin—by cable to Madrid, and thence by wireless to Berlin.—*The Times.*

South Africa.—Owing to the approaching exhaustion of stocks and the impossibility of obtaining supplies, the Postmaster-General announces that the extension of the telephone service must be restricted to the minimum until the stock of materials can be replenished.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Melbourne.—October 10th. Department of the Navy. Pumping plant and equipment for the Commonwealth Naval Dockyard, Cockatoo Island, Sydney. Specifications from the Director of Navy Contracts, Melbourne.

Kirkcaldy.—October 2nd. Corporation. Converting plant and switchgear. See "Official Notices" September 14th.

Liverpool.—September 24th. Electrical supplies for three months, for Toxteth Park B. of G. Mr. R. A. James, Clerk, 15, High Park Street.

London.—Kensington.—September 27th. B. of G. Six months' supply of electric fittings and lamps. Mr. W. R. Stephens, Clerk to the Board, Guardians' Offices, Marloes Road, W. 8.

Manchester.—September 25th. Corporation Tramways. Pitch. Mr. J. M. McElroy, General Manager.

September 27th. Lancashire and Yorkshire Railway. Various stores, including (39) signal and telegraph wires. Mr. Waring, Stores Department, Osborne Street, Manchester.

Merthyr Tydfil.—September 24th. B. of G. Electrical accessories for six months. Mr. F. T. James, Clerk, 134, High Street.

CLOSED.

Glasgow.—The Electricity Committee reported to the T.C. that it had considered the tenders received for the reinforced concrete superstructure for one boiler house, turbine room, and workshop at the new generating station, Dalmarnock, and recommended acceptance of the offer of Messrs. Train and Taylor, at £64,539, it being the lowest.

The engineer reported on the tenders received for (1) boiler-house plant and (2) E.H.T. switchgear for the new generating station at Dalmarnock, and the Sub-committee, after consideration, agreed to recommend acceptance of (*a*) an offer by Messrs. Babcock and Wilcox, Ltd., for eight boilers, stokers with forced and induced draught, economisers, chimneys, feed pumps, and piping, for £140,282; and (*b*) an offer by Messrs. A. Reyrolle and Co., Ltd., to supply and erect 12 sets of E.H.T. switchgear for the power-house there, for £33,985. At a subsequent meeting it was reported that there had been considered a letter from Messrs. Babcock & Wilcox, Ltd., stating that the cost of labour and material in connection with their contract for providing and erecting a coal conveyor and transporter at the new works at Dalmarnock had increased by at least £5,700, and asking that they should be allowed an additional sum of £5,000 on their contract price of £24,000. Having heard the engineer, the Committee was of opinion that the increased price asked for was reasonable in the circumstances, and agreed to recommend that the same be granted.

The engineer reported that additional switchgear would be required at the various sub-stations, and the Sub-committee authorised him to order from Messrs. A. Reyrolle & Co., Ltd., 27 panels, at £14,210.

Government Contracts.—List of new contracts placed during August, 1917 :—

War Office.

Dry batteries.—Houghton-Butcher Manufacturing Co., Ltd.
Battery boxes.—T. & J. Hughes; F. Restall, Ltd.
Insulator brackets.—Bullers, Ltd.; Butterworth & Dickinson, Ltd.; Douglass Bros., Ltd.; G. Wilson & Co., Ltd.
Electric cable and wire.—B.I. & Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph & India-Rubber Works, Ltd.
Dynamos.—General Electric Co., Ltd.
Ebonite rod.—St. Helens Cable & Rubber Co.; Siemens Bros. & Co., Ltd.
X-ray equipment.—Cavendish Electrical Co., Ltd.
Electric light fittings and accessories.—Elm Works, Ltd.; Eveson Bros., Ltd.; E. Stevens, Ltd.; J. Stevens, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.
Electric motors.—Electric Construction Co., Ltd.
Electrical plant.—Harland Engineering Co.
Iron and steel wire.—R. Johnson & Nephew, Ltd.; Shropshire Iron Co., Ltd.
Switches.—General Electric Co., Ltd.

India Office Store Department.

Copper plates.—Williams, Foster & Co.; Pascoe, Grenfell & Sons.
Copper wire.—T. Locker & Co.
Wire.—R. Johnson & Nephew, Ltd.; Whitecross Co.; B.I. & Helsby Cables, Ltd.

Post Office.

Telegraph apparatus.—British L. M. Ericsson Mfg. Co., Ltd.; Siemens Bros. & Co., Ltd.
Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; B.I. and Helsby Cables, Ltd.; British L. M. Ericsson Mfg. Co., Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Thornton-Pickard Mfg. Co., Ltd.; Waltham Cross Joinery Co.
Submarine cables.—Siemens Bros. & Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telegraph cables.—B.I. & Helsby Cables, Ltd.; Hackbridge Cable Co., Ltd.; I.R., G.P. & Telegraph Works Co., Ltd.; Telegraph Construction and Maintenance Co., Ltd.
Telephone cables.—B.I. & Helsby Cables, Ltd.; Johnson & Phillips; New Gutta-Percha Co., Ltd.; Telegraph Construction & Maintenance Co., Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Dry cells.—British Ever-Ready Co., Ltd.
Plates for stay-rods.—Walker Bros., Ltd.
Insulator rings.—C. Macintosh & Co., Ltd.
Pole steps.—Guest, Keen & Nettlefolds, Ltd.
Stay swivels.—Bullers, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; Shropshire Iron Co., Ltd.; F. Smith and Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Copper wire.—T. Bolton & Sons, Ltd.; Elliott's Metal Co., Ltd.; Johnson and Nephew, Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.); Wilkes, Son & Mappebeck, Ltd.
Enamelled and flameproof wire.—Fuller's Wire & Cable Co., Ltd.
Galvanised-iron strand wire.—Rylands Bros., Ltd.; Whitecross Co., Ltd.
Steel wire.—Rylands Bros., Ltd.
Switchboard wire.—B.I. & Helsby Cables, Ltd.

London.—St. Pancras.—B.C. New air-pump for the converted 1,500-kw. Ljungstrom turbine at the King's Road station, £300: Brush Electrical Engineering Co., Ltd.

Poplar.—Electricity Committee. Recommended :—

Overhead crane for High Street sub-station.—Herbert Morris, Ltd., £447.
Steam piping.—Aiton & Co., £224.

Southend-on-Sea.—T.C. Electricity Department :—

Callender's Cable & Construction Co., Ltd.—100 service boxes, 11s. 6d. each.
Bellis & Morcom, Ltd.—Piston and piston rings, £20 14s.

FORTHCOMING EVENTS.

Association of Supervising Electricians.—Tuesday, September 25th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Presidential address by Mr. J. S. Highfield.

NOTES.

Foreign Trade.—The August Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

	August, 1917.	*Inc. or dec.*	8 *months*, 1917 *Inc. or dec.*
Imports.			
Electrical goods	97,318	— 12,137	— 151,919
Machinery	817,910	+199,475	— 278,158
Exports.			
Electrical goods ...	257,172	—152,337	— 645,600
Machinery	1,644,351	—289,359	+ 717,211

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W. 1.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Officer for the Week.—Second Lieut. C. E. Campbell.
Monday, September 24th.—Technical instruction (searchlight) for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class, 6.30. Recruits' Drill, 6.30.
Tuesday, September 25th.—Physical drill and bayonet fighting.
Wednesday, September 26th.—Drill and elementary bridge construction for No. 1 Company, Right Half Company.
Thursday, September 27th.—Drill and elementary bridge construction for No. 2 Company, Right Half Company. Signalling Class, 6.30. Ambulance Class, 6.30.
Friday, September 28th.—Technical instruction (searchlight) for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.
Saturday, September 29th.—Commandant's Parade for route march and drill. Parade at Headquarters, 2.45 p.m. Uniform. Recruits' drill, 2.30.

(By order) MACLEOD YEARSLEY, *Capt. and Adjutant.*

Nitrolim.—In a recent lecture on the manufacture of cyanamide and kalkstickstoff (nitrolim), delivered in May last at Vienna, M. Dolch had remarked that the Swedish process of making the cyanamide in vertical shaft furnaces was not profitable, because the electrode consumption was high, and the nitrogen percentage of the final product rather low. Mr. P. Carlkson, of the Aktiebolaget Nitrogenium, Ljungaverk, replies to this remark in a recent number of the *Chemiker Zeitung*, refuting the statement and giving some interesting particulars. The carbon electrodes, he says, are Plania or Höganäs electrodes, 350 mm. in diameter, which is not at all an exceptional size. There is no loss of pieces of the electrodes, which are constantly being lengthened. The electrode consumption is 3·75 kg. to 5·5 kg. per ton of kalkstickstoff, which is supplied in a porous ground mass containing 19 per cent. or 20 per cent. of nitrogen. The product is said to be very uniform just because the carbide gradually descends in the shaft furnace; 725 kg. of carbide yield one ton of kalkstickstoff. The furnace process is continuous, and it does not take so long as with other furnaces to start operations again after some breakdown in the power house. In short, the process is described as both reliable and economical.—*Engineering.*

Tar Oil as Fuel for Diesel Engines.—In view of the recent Orders made by the Ministry of Munitions regulating the use of creosote and other oils produced from the distillation of coal, the DIESEL ENGINE USERS' ASSOCIATION has taken action to assist as far as possible in making arrangements for the necessary supplies of tar oils for its members. The present difficulty of obtaining a sufficient supply of petroleum residual oil as fuel for Diesel engines has led a large number of users to adopt tar oil.

At the present time, "Creosote Licences" are only being granted for a period of two months, but the Association is hopeful that its members may shortly be able to obtain licences for the use of tar oil for longer periods, so as to facilitate arrangements in making contracts for regular supplies. The honorary secretary of the Association has collected particulars of the requirements of the various members who use, or who contemplate using, tar oil, and these, together with other information, have been submitted to the Director of Munitions Petroleum Supplies.

Cast Iron as a Bearing Metal.—When one considers the suitability of cast iron as a bearing material, it is a matter for wonder why it is not more generally used. Designers are so used to the usual run of bearing material that they appear unable to accept the evidence of their own eyes. Let any engineer look round his plant, and he will find plenty of evidence of the successful use of cast-iron. Personally, the writer is prepared to use cast-iron in practically every case where the copper alloys are at present used. In his present shop are dozens of shafts running in cast-iron bushes up to 3 in. in diameter, and up to 1,000 R.P.M., and they give very little trouble—certainly no more than brass. Strange to say, most of these are on American and Continental machines. When the comparative costs of the copper alloys and cast-iron are taken into consideration, it will be seen that considerable economy can be effected by the use of the latter in preference to the former, with no reduction in efficiency. This fact will have to be taken into account at no distant date, and it behoves British designers to give the matter serious consideration. One little hint may be of use. When using cast-iron as a bearing material, provision should be made for renewable bushes, as is usual when brass is used. Most makers, when using cast-iron, simply bore holes in the castings composing the machine. When it is required to re-bush the holes, considerable trouble and expense are incurred by having to re-bore them to admit bushes.—G. B., in the *Mechanical World.*

The Engineering Council of the United Engineering Societies, U.S.A.—On June 27th was held the first meeting of the Engineering Council. This body is a department of the United Engineering Society, and has recently come into being as a medium of co-operation among the four national engineering societies. The function of the Council may, perhaps, best be described by the following extract from the by-laws of the United Engineering Society:—"The Council may speak authoritatively for all member societies on all public questions of a common interest or concern to engineers." The Council is composed of 24 members, five being appointed by each of the four founder societies and four by the United Engineering Society. At the organisation meeting the following officers were elected:—President, I. N. Hollis; vice-presidents, H. W. Buck, George F. Swain; secretary, Calvert Townley; Executive Committee, the four officers named, with J. Parke Channing and D. S. Jacobus.

The Council discussed at length ways and means by which the founder societies, through the Council, might be of use to the nation. The unanimous desire to help the Government in the prosecution of the war resulted in a resolution instructing the Executive Committee to co-operate with the Government in procuring the services of engineers, also the appointment of a Committee of three to consider the best means of utilising the inventive ability of members.

The secretary was instructed to inform all Government bureaus that might be interested in the organisation of the Engineering Council and its desire to be of assistance.—*American Machinist.*

A New Permanent-Magnet Steel.—A new steel of considerable importance has been made in the United States for the last year or so, directly the outcome of war conditions. It is a new permanent-magnet steel, a substitute for the older steel, known as tungsten magnet steel, which was used exclusively for this purpose before the war.

The new steel, which is reported to be not less than 90 per cent. as efficient as the old permanent-magnet steel, is a 0·90 per cent. carbon steel containing about 2 per cent. of chromium, and is now being made in electric furnaces in the U.S.A. and extensively used by many consumers.

This new type of steel is based on investigations made by Dr. John A. Mathews, of Syracuse, N.Y., and published by the American Society for Testing Materials about three years ago, in which it was pointed out for the first time that certain types of steel were better magnetically when quenched in oil than when quenched in water. This statement was entirely contrary to all previous ideas regarding the hardening of steel for permanent magnets.

Magnetically this new chromium steel is equal to tungsten magnet steel in permanence, but somewhat lower in residual density. Users have found it possible to substitute this steel for the older steel without making any change whatever in their windings or in the cross sections of the magnets used.

Practically chrome magnet steel, as the new steel is called, is not as good as the tungsten magnet steel, because it requires oil hardening, which is not as convenient as water hardening, and also because chrome steel in its natural state is much harder to drill or machine, and the steel itself must be handled with greater care and uniformity in heat treatment than is necessary with tungsten steel.—*Scientific American.*

Revamping the Central Station.—The change in generating practice brought about by the introduction of the steam turbine some 15 years ago has been very startling in its results, and particularly so in the case of big city plants, in which economy of space may become nearly or quite as important as economy of coal. A very excellent example of what has happened will be found in the remodelling of the St. Louis generating station, which in its first stage of existence some 14 years ago happened to be one of the last big plants with reciprocating engines. The great cross-compound reciprocating engines of the original plant had scarcely more than settled down to their bearings before it was necessary to increase the station capacity, and four 5,000-KW. turbine generators were added. The original boiler plant consisted of 28 Scotch boilers. To take care of the new units 40 water-tube boilers were added on an upper deck. Three years later more output was required, and the four turbines were replaced, after only three years' service, by 12,000-KW. turbines. Again more steam was needed, and 12 of the Scotch boilers were replaced by water-tube boilers. So far as the turbine plant was concerned, it now had 52 boiler units to provide steam for 48,000 KW., as against 40 boilers for the 20,000 KW. The generating equipment remained in this stage of evolution for seven years, and then there was another forward movement. This time one of the original 3,000-KW. reciprocating engine sets was removed, and in its place was installed a 20,000-KW. horizontal turbine. For this unit the remaining 16 Scotch boilers came out and 10 water-tube boilers went in, with 2,000-KW. capacity per boiler. With the greatly increased output two of the reciprocating sets were removed and their room was utilised for the extension of the switchboard space. Finally, plans are now under way for abolishing the remaining two old units and putting two 20,000-KW. turbines in their place. One rarely sees a more striking example of the very radical changes in practice wrought by a few years' development. It would not be unsafe to prophesy that when the two new units go into place they will not require 10 boilers apiece.—*Electrical World.*

The Decimal System.—Recently a "questionnaire" was circulated among the members of the Chartered Institute of Secretaries for the purpose of obtaining opinions in regard to the adoption of a decimal system of coinage in the United Kingdom and the substitution of the metric system for the existing United Kingdom weights and measures. Of the replies received, 85 per cent. considered that a change to a decimal system of coinage would be favourable to the business in which they were engaged, and 66 per cent. favoured a £ basis of coinage in preference to the "Imperial Crown" or dollar basis.

With regard to weights and measures, 86 per cent. favoured a change to the metric system, 53 per cent. of whom already used that system in their businesses. The large majority were of opinion that the metric system not only facilitated their internal office work, but had led to extended business relations with other countries, including France, the United States, Russia, and the Argentine. In 61 per cent. of the replies the business of the company was stated to be hindered by the use of the existing system of weights and measures.—*Financier.*

Training Apprentices for the Electrical Trades.—The need for technical instruction of a specialised nature for apprentices in the electrical trades has long been felt, and it will be remembered that some time ago Mr. R. W. Paul in particular endeavoured to bring about a reform in this respect, with especial reference to the requirements of electrical instrument makers. The teaching institutions, we believe, held that their ordinary classes adequately met the case, but manufacturers considered that these courses were of too general a character, and Mr. Paul organised a special instruction department in his own works to provide the training which he thought necessary. The whole subject will be dealt with, no doubt, by the Ministry of Education in connection with its new schemes, but in the meantime we are glad to learn that the Northampton Polytechnic Institute has led the way by inaugurating day and evening courses for apprentices and others in the electrical trades, which will open shortly.

It is recognised that evening instruction alone is unsuitable for boys from 14 to 17 years of age; in the announcement issued by the Principal, Dr. R. M. Walmsley, it is urged that at least a part of the training should be given in the daytime, not less than one whole afternoon a week being devoted to technical instruction. In addition, the general education of the boys leaving the elementary schools should be continued, and for this purpose evening classes will be held at the Junior Technical Institutes of the L.C.C., affiliated to the Northampton Institute, on two nights a week in English, calculations, general subjects, and gymnastics, the work of the elementary schools being thus continued, with a technical bias directed towards the industry in which the boys are engaged. In future sessions, as the scheme develops, the courses will be elaborated. Provision is made in the day courses at the Northampton Polytechnic Institute for three grades of apprentices, and the evening classes there, as well as at the Junior Technical Institutes, will be co-ordinated with the day work. The courses can only be held if a sufficient number of enrolments is received by Friday, September 28th, and it is to be hoped that employers will take immediate action to induce their apprentices to apply for admission.

Messrs. Marryat & Place, who for some years have been deeply interested in this question, and are entirely satisfied with the proposals of the Institute, are sending some 20 students, and are anxious to have the support of other members of the trade. The importance of the matter in these days can hardly be exaggerated, and we hope that the opportunity to assist in this movement will be seized by the electrical manufacturers in the London area.

Fatality.—A verdict of "Accidental death" was returned at an inquest held at Derby to inquire into the death of Harold Canham, 24, who was killed while following his employment as an engineer at Messrs. Newton Bros.' Electrical Works. According to the *Nottingham Guardian*, the deceased was connecting a motor to the supply for testing purposes, and was holding a copper bar with one hand and the framework of the switchboard with the other, when apparently he slipped, and one of his hands came in contact with a live wire, and he was held until the current was cut off by an apprentice; he then dropped. Attempts at resuscitation proved unavailing.

The test-bed foreman, John Husbands, said it was the rule that the current should be cut off before such an operation was commenced, and he thought that deceased must have turned it on unthinkingly. The voltage was 400.

Metropolitan Power Station Engineers.—A meeting was held at St. Bride's Institute, on September 14th, of the London A.E.S.E. Committee and other representatives of the engineering staffs of London electricity supply stations. The Press report of the conference between the Electrical Trades Union and the Associated Municipal Electrical Engineers, under the auspices of Sir G. R. Askwith, dealing with the rates of pay, &c., of charge engineers, was discussed. It was decided that the secretaries of kindred Associations should be approached, with a view to a joint protest being made to Mr. G. R. Askwith to the effect that the E.T.U. does not represent the central station engineers of the London area, and that a joint conference should be held at St. Bride's Institute on September 25th, at 7 p.m., to decide the action to be taken in the matter.

South African Municipal Electrical Engineers in Conference.—The second annual Conference of the Association of Municipal Electrical Engineers (Union of South Africa), which was founded in 1915, was to take place at Durban from August 27th to September 1st. We have received an advance copy of the programme, but, under the prevailing conditions, the report of the proceedings will probably not come to hand for a while.

Owing to the war and depleted staffs many of the Association's 31 members were unable to attend, and one at least was on Active Service. It was, however, anticipated that some 16 engineer members and about 8 Councillor delegates would attend. The Natal Society for the Advancement of Science and Art (Engineering Section) was also taking part, and a useful and instructive week was anticipated. One of the most important subjects to be considered was that of "Standardisation," in connection with which a Standards Committee has been meeting regularly at Johannesburg, consisting of representatives of the following bodies:—S.A. Institute of Electrical Engineers, S.A. Institute of Engineers, Association of Municipal Electrical Engineers (S.A.), Engineering Section Natal Society for the Advancement of Science and Art, British Electrical and Allied Manufacturers' Association, Institution of Electrical Engineers (England), and Government Departments, Union of S.A.

It was anticipated that some important representations and proposals would be forthcoming from the Convention regarding electrical standardisation as affecting municipalities.

The opening meeting was to take place at the Town Hall, Durban, on Monday, August 27th. The official welcome by the Mayor was to be followed by the annual general meeting for the receipt of reports, election of president, secretary, and other officers. After the official luncheon a visit was to be paid to Messrs. Lever Bros.' Soap Works. On Tuesday the presidential address was to be delivered by Prof. J. H. Dobson, and a discussion on "Tariffs," led by Mr. John Roberts, was to follow. Other events of the day included a visit to the Harbour Works and coaling plant, and, in the evening, a paper on "South African Municipal Electrical Undertakings," by Mr. Poole, assistant electrical engineer, Durban. On Wednesday the party was to meet at Pietermaritzburg, and the events included a visit to the municipal power station there, an official luncheon by the Mayor, and a paper on "Gas Plants," by Mr. F. Castle, municipal electrical engineer, Oudtshoorn. Thursday, back at Durban, a paper by Mr. J. Roberts, on "Standardisation," was down for discussion, followed by a visit to the municipal power station and dinner at the Royal Hotel. On Friday, Mr. J. Hamlin, municipal electrical engineer, of Stellenbosch, was to introduce "The Design and Management of Small Power Installations," followed by an afternoon visit to the Explosives Works of the Sugar Factory. Saturday, September 1st, was left free for any business meetings or adjourned discussions that might be arranged.

Board of Trade Urges British Manufacturers to Combine.—At a meeting of the Birmingham Brass Masters' Association, held on Monday, important addresses were delivered by Mr. L. A. Paish, of the Commercial Intelligence Department of the Board of Trade, and Mr. C. Hamilton Wickes, H.M. Trade Commissioner for Canada. Mr. Paish said that the Board of Trade had closely followed the syndicating efforts of German industry, and they were convinced that it was absolutely essential for British manufacturers to get together into some sort of trading combination if they were to regain lost trade and to increase their export trade after the war. Combination would have to meet combination. The speaker went on to show that Birmingham brass masters could in combination systematically investigate a market, whereas an individual firm would be unable to do so. By means of an Association of the whole of the products of the brass industry, a man could be put into any market thoroughly to study the changes that had taken place during the war. The Board of Trade Commercial Intelligence Department was prepared to co-operate in every possible way to that end, even, says the *Times* report, to the extent of financial assistance in the sending out of such a representative. The Department was out to give manufacturers and traders all the assistance they could reasonably expect. He was instructed to take steps to get the formation of a trading Association for the brass industries actually going; if they did not combine, they would go under. Mr. Hamilton Wickes, who followed, said that what German manufacturers had done in the past in certain lines would be done by the German nation—namely, it would purchase as one body the raw material required from outside countries for its vital industries. Was it not time that British manufacturers got together?

American Lumbermen for France.—The regiment of lumbermen, for service with the United States Army in France, has been recruited to full strength. The "lumber-jack regiment," as this is known, is for service in the woods of France, getting out material for the use of the Army. The enlistments were secured through the Forest Service, and the men comprise practical lumbermen and foresters. For this work the regiment will go thoroughly equipped with portable and stationary electrically-driven sawmills, lighting outfits and transportation facilities.—*Electrical Review*, U.S.A.

The A.S.E.—The Amalgamated Society of Engineers reports that at June, 1917, its general fund and superannuation reserve fund stood at £1,952,786, an increase of £210,999 for the quarter. £730,000 of the total is due to the superannuation reserve fund.

Educational Notice.—City of London College, Moorfields.—The new session for Business and Commercial courses commences on October 1st. Prospectuses can be obtained from the Secretary.

The Electrodeposition of Zinc.—"Borrodising" is the name given by the Deptford Steel and Iron Works, Ltd., to a system of electrodeposition of zinc which they have introduced as a preventive against corrosion of the steel fittings of aeroplanes and seaplanes. It is described as a method of cold electrogalvanising carried out in such a way that the zinc so unites with the underlying metal that only by extreme wear can the surface of the steel be exposed. As the metal is not subjected to the usual pickling bath prior to the galvanising, it is claimed that there is no reduction in the strength of the metal after treatment. We understand that the process has been approved by the Air Department, the Admiralty, and the War Office, and that the company has installed a large plant to deal primarily with all steel fittings employed in the manufacture of aircraft.

Engineering Congress.—The *Génie Civil* gives further particulars of the "First General Congress of Civil Engineering," which is to be held for the study and inauguration of "After-the-War Programmes." The first seven sections are styled "technical"; three other sections have now been constituted to deal with economics. The Congress will discuss methods of reorganising French industries on the most modern lines, and the various sections and sub-sections have already made substantial progress in preparing their agendas.

Legal.—At Nuneaton, Wm. Docking (18), miner, was charged with stealing 11s., the moneys of the Nuneaton Corporation. The town clerk stated that for some time past the electric lighting slot meters had been tampered with and money extracted. Prisoner had procured a key and gone about emptying slot meters. There were 18 cases altogether against him, but he only proposed to go into three, the amounts involved being £1 15s., for which defendant's solicitor had sent a cheque. Mr. Clay said prisoner's parents had offered to refund the whole of the money, £8 4s. Prisoner was sent to prison for three months.

Liability for Samples.—In the City of London Court, on September 18th, before his Honour Judge Rentoul, K.C., an action was brought by William Whitehouse & Co., Ltd., Empire Works, Brulton Street, Birmingham, electric light and gas fitting manufacturers, against Messrs. Lyall Willis & Co., electric light and gas fittings merchants, Billiter House, Billiter Street, E.C., to recover the sum of £34 19s. 9d., as damages for breach of contract, dated July 17th, in which the defendants agreed to return certain electric light and gas fittings at the expiration of the agreement. Mr. Goodman, plaintiffs' counsel, said alternatively the claim was for the return of the goods wrongfully detained, or £39 19s. 9d. their value. Defendant said he had done everything in his power to hasten the return of the samples from India. The non-return was largely due to restrictions and shipping conditions imposed by the Board of Trade. Judge Rentoul thought it was quite reasonable of plaintiffs to ask that they should be paid the value of the samples, and, of course, costs, and plaintiffs would return the money if the goods came to hand within a certain time—say, six months. Mr. Goodman said the plaintiffs were willing to agree to these terms, subject to the goods being returned before March 1st. Judge Rentoul said he would give judgment for the plaintiffs for the amount claimed, with costs, and they would refund the money if the defendant returned the goods before March.

Cape Town.—The manager of the Southern Cross Cold Storage Co. was recently charged with abstracting 30 units of electrical energy from the installation in premises occupied by Chiat & Co Mr. J. Power, installation superintendent for the City Corporation, deposed that two circuits, which supplied light to the premises occupied by the Southern Cross Co., had been connected to Chiat's meter without the authority of the Corporation. Charles Zion, manager for Chiat & Co., stated that no permission had been given to the Southern Cross Co. to make the connection. The Magistrate, however, came to the conclusion that the accused had not acted with any criminal intent, and discharged him.

A Dundalk Consumer Prosecuted.—The Dundalk magistrates sent for trial at Quarter Sessions, Dominica Mezza, prosecuted by the local Urban Council, for alleged fraudulent consumption of electricity. Mr. P. A. Spalding, the Council's electrical engineer, stated that one of the seals on Mezza's meter came off the sealing wire easily, and the other had disappeared. The jointer removed one of the wires, and when the lights were switched on every lamp in the place lit up, which showed that the current went direct to the lamps without going near the meter. He estimated the value of the electricity abstracted at £2 at least. The jointer, Frank Wilson, said he did not think it possible that a Council official could have diverted the current while regulating the meter.

Institution and Lecture Notes.—Electrical Association of Australia (N.S.W. Section).—At the monthly meeting held in Sydney, on June 8th, an illustrated lecture was delivered by Mr. Russell Sinclair, dealing with munition work and developments in England.—*Commonwealth Engineer.*

South Australian Institute of Engineers.—At the annual meeting, some notes were given by a member on the Bille-Creed automatic telegraph system.—*Commonwealth Engineer.*

Association of Supervising Electricians.—The first meeting of the new session is to be held on Tuesday next, September 25th, at 7.15 p.m., at the St. Bride's Institute, E.C. The President, Mr. J. S. Highfield, will deliver his inaugural address. Other arrangements for the session are as follow (all meetings are on Tuesdays):—

October 30th.—"Switchboard Telephone Equipments," by Mr. T. F. Lee.
December 4th.—"Transformers" (author to be appointed by Westinghouse Co.).
January 15th, 1918.—Half-yearly meeting and informal discussions.
February 19th.—"Cable-laying," by Mr. E. S. Byng.
March 26th.—Paper by Mr. F. H. Taylor.
April 30th.—"D.C. Motors," by Mr. E. F. Butler.
June 25th.—Annual meeting.

S.A. Institution of Engineers.—At the adjourned annual general meeting of the Institution, on July 14th, Mr. Bernard Price, President, announced that Mr. G. M. Clark had been elected President for the 1917-18 session, and installed him in the chair.

Canal Transport.—The reorganisation of the English canals under the Canal Control Committee has now attained a stage at which the Committee is able to invite traders to send their goods by canal instead of by rail, in order to relieve the traffic on the railways.

Appointments Vacant.—Charge engineer for the Walsall Corporation Electric Supply Department; meter and mains assistant (50s.), for the Loughborough Corporation electricity department. For particulars see our advertisement pages to-day.

Old Lamp Tops.—A correspondent inquires as to the best method of recovering platinum from old electric lamp tops, and also how to test the metal and distinguish it from substitutes.

Wages Increase at Melbourne.—"Threatening to strike and thus paralyse city industries, and practically envelop the city in darkness if the demands were not acceded to, the employés of the Melbourne City Council undertaking have been granted increased wages. The rates agreed upon and those paid by the Melbourne Electric Supply Co. are as follows:—Engine drivers, 13s. 6d., increase 10d., (M.E.S. 13s.); assistant engine drivers, 12s. 6d., increase 10d. (M.E.S. 11s.); leading firemen, 12s. 6d., increase 4d. (M.E.S. 12s. 6d.); firemen, 11s. 6d., increase 10d. (M.E.S. 11s.); trimmers, 10s. 6d., increase 10d. (M.E.S. 10s.); coal conveyor attendants, 11s., increase 10d.; switchboard attendants, increase 1s. 4d.; sub-station attendants, 12s. 6d., increase 1s. 4d.; dynamo attendants, 10s. 6d., increase 10d."—*Commonwealth Engineer.*

British Ignition Apparatus Association.—The address of Mr. Ernest Garton, honorary secretary of this Association, is now 9, Northumberland Road, Leamington Spa, where all letters and communications in connection with the Association should be sent.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—A commission in the Royal Engineers has been granted to Mr. Herbert Pursey, who held a position as an electrical engineer at Calcutta, and left India to volunteer for active service.

In a reply to criticisms at a meeting of the Dublin Corporation, Mr. Mark Ruddle, city electrical engineer, informed the Electricity Supply Committee that he was not a member of any Lodge—Masonic, Orange, Hibernian, or Sinn Fein—and denied that he had ever been threatened by any member of his staff.

Exeter City Council, at Tuesday's meeting, approved of the electrical engineer, Mr. Munro, acting as the local representative of the Coal Controller, subject to the work not interfering with the performance of his ordinary duties. The engineer's task will include visits to the principal local authorities in Devon and Cornwall, and is honorary. The Controller desires to promote the use of electricity, gas, and coke from local supplies in place of coal, wherever possible, and to facilitate the interconnection of electrical stations.

General.—It is stated in the newspaper Press that Sir A. Steel-Maitland, the present Under-Secretary at the Colonial Office, has been offered, and has accepted, the position of Chief of the new Commercial Intelligence Service of the Foreign Office and the Board of Trade.

Communications for Mr. J. Wilkinson, tramway electrical engineer, Hull, should in future be addressed:—Tramway Power Station Buildings, Osborne Street, Hull.

Mr. James Livingston, for the past five years assistant postmaster at Leeds, retires at the end of September, after 47 years' service. He commenced in Glasgow in 1870, being transferred to Leeds in 1906, as chief inspector of telegraphs, and five years ago became assistant postmaster. He entered the service about the time of the nationalising of the telegraph, and took part in the work of co-ordination following on the change from the widely differing methods of the companies taken over. In Glasgow he was a lecturer in the electrical engineering department of the West of Scotland Technical College.

The *Daily Telegraph* states that Sir Arthur Whitelegge, K.C.B., who has held the appointment of His Majesty's Chief Inspector of Factories and Workshops at the Home Office for more than 21 years, will retire in the course of next month on reaching the age limit of 65, and the Home Secretary has appointed Mr. H. M. Robinson, the senior Deputy Chief Inspector, to succeed him. Sir Arthur will continue to give his services to the Factory Department in an advisory capacity on questions of a technical and scientific character. Mr. R. E. Graves, the junior Deputy Chief Inspector, will now become senior Deputy Chief Inspector, and Mr. Gerald Bellhouse, Superintending Inspector of Factories, has been appointed junior Deputy Chief Inspector.

It is stated that the Deputy-Controller for Auxiliary Shipbuilding, Admiralty, has appointed Lieut.-Colonel J. Mitchell Moncrieff, R.E., M.Inst.C.E., to be Director of Engineering Work, to deal generally with all civil engineering matters which may arise in connection with his department.

Mr. G. M. Clark, formerly of the engineering staff of the Victoria Falls Power Co., has, according to the *South African Mining Journal*, been elected President of the S.A. Institution of Engineers for the year 1917-18.

At the Midland Hotel, Manchester, on Thursday last week, the staff of Mr. L. E. Wilson, of Manchester, welcomed the

safe return of Mr. D. G. Sumner, the chief engineer, after carrying out some important work for the firm in Persia. Those present, especially the telephone engineers, were interested in his account of the difficulties experienced in carrying out technical work in the Far East.

Roll of Honour.—We regret to record that Rifleman W. H. Beck, Rifle Brigade, was killed in action on July 31st, aged 34. Rifleman Beck was a member of the staff of the Electrical Review Printing Department, which he entered as an apprentice 20 years ago. He will be remembered by his associates for his quiet and unassuming disposition, and will be greatly missed. We also regret to learn that Company Sergt.-Major H. Childe, an assistant in the Editorial Department of the Electrical Review, has been wounded, and is in hospital in France. Both Rifleman Beck and Company Sergt.-Major Childe were members of the Electrical Review Rifle Club.

The following employés of the County of London Electricity Supply Co. have been killed in action:—Private F. H. Bent, 3rd S. Wales Borderers; Private A. Goldsworth, 23rd County of London Regiment; Private L. W. King, 4/2 County of London Royal Fusiliers; Lance-Corporal E. A. Price, 1st Battalion Essex Regiment; Driver James E. W. Purcey, R.F.A.; Private G. White, R.A.M.C.; Gunner W. Whapshott, R.G.A.

Lieutenant Lewis Peake, late sub-station attendant in the Poplar B.C. electricity department, has been killed in action.

Lance-Corporal W. Henderson, K.O. Royal Lancaster Regiment, who has been wounded, was employed at the Bispham District Council electricity works.

Private H. Davenport, Gordon Highlanders, who was employed at the British Westinghouse Works, Trafford Park, has been killed in action.

Private W. Lowe, S. Lancashire Regiment, reported killed in action, after being missing since October last, was employed by the St. Helens Cable & Rubber Co., Ltd.

Sergeant A. Clarkson, R.F.C., aged 23, reported killed after a raid over the enemy's lines, was employed by Messrs. Calverley & Co., electrical engineers, Burnley.

Sapper W. Williamson, R.E., who has been dangerously wounded, aged 40, was employed by Mr. F. G. Waters, electrical engineer, Leeds.

Corporal C. Carpenter, R.E., awarded the Military Medal for rescuing wounded under fire, was engaged at the Charlton works of Messrs. Siemens Bros.

Private M. O'Connor, Cheshire Regiment, reported killed, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private A. H. Campion, Essex Regiment, who has died of wounds, was in the electrical department of Messrs. S. Pearson & Sons, West Thurrock, Grays.

Private F. Dimmock, London Regiment, who was with the Telegraph Construction & Maintenance Co., of East Greenwich, has been killed in action.

Gunner C. Hughes, R.F.A., who was with Henley's Telegraph Works Co., Ltd., North Woolwich, has been killed in action.

Wireless Operator A. C. Truman, reported missing (aged 31) after the torpedoing of a merchant steamer, had been for 15 years with the Marconi Co.

Gunner W. D. Duncombe, for some years at the Rugby works of the B.T.H. Co., has been killed in action.

Private Tom Whitham, of the Coldstream Guards, who has been awarded the Victoria Cross, was employed in the Burnley Corporation tramways department. In a letter to Mrs. Witham, Mr. H. Mozley, tramways manager, has sent his congratulations.

Private J. J. Walker, Cameronians, killed in action, was an electrician engaged with a firm at Dornoch, Annan.

Private Geo. Rawson, Royal Berks. Regiment, who has been killed in action, was with Messrs. Thompson, electrical engineers, Kettering.

Sapper J. E. West, W. Lanc. Sign. Section, who has been awarded the Military Medal, was employed as a wireman at the United Electric Car Co.'s works, Preston.

The Military Cross has been awarded to Lieutenant N. F. Hawes, Machine Gun Corps, of the County of London Co.'s mains department, for bravery in action on the French front on June 21st, 1917.

Obituary.—Mr. J. E. Tongue.—The death is reported of Mr. J. E. Tongue, Ash Mount, Rotherham, partner in the Rotherham Electrical Engineering Co., Ltd.

Mr. T. Mitchell, Sen.—Mr. Thomas Mitchell, sen., passed away, in his 76th year, on September 16th at his residence near Bolton. Until a few years ago the deceased gentleman was senior partner in the firm of Messrs. Thomas Mitchell and Sons, engineers and merchants, Bolton. The business is being continued by his sons.

Will.—According to the *Times*, Mrs. Elizabeth Dack Denning, of South Norwood, widow of the late Ald. Denning, of Croydon, has left estate of the gross value of £169,719, the net personalty being £78,581. The testatrix bequeathed to the Public Trustee all her freehold property in trust for a "Frank Denning Memorial" for the advancement and propagation of education in mechanical science in any part of the United Kingdom, with preference to those persons who reside in the Borough of Croydon.

NEW COMPANIES REGISTERED.

British Automobile Equipment Co., Ltd. (148,441).—Private company. Registered September 11th by Elvy, Robb & Welch, 19, Bedford Row, W.C. Capital, £100,000 in £1 shares (50,000 7 per cent. cum. pref.). Objects: (1) To acquire certain patents and rights (a) from Accuratact Magnetos, Ltd., and H. D. Grant, and (b) from H. D. Grant, (2) to acquire from F. Lamplough the business of an aviation, motor, and general engineer carried on at Highfield Works, Feltham, Middlesex, as Lamplough & Co., and certain freehold lands, plant, buildings, &c., (3) to enter into an agreement appointing G. F. Cooke electrical engineer. The subscribers (each with one pref. share) are: J. J. Sneddon, Finsbury Pavement House, E.C., chartered secretary; S. Fortescue, Finsbury Pavement House, E.C., company director; B. Hedley, 7, Great Elms Road, Bromley, Kent, clerk; A. T. Pendry, 14, Heathland Road, Stoke Newington, N., company director; V. W. Comer, 5, Cawley Road, E. 9, accountant; J. E. Cater, 45, Arabin Road, Brockley, S.E., clerk; F. W. Ramsey, 32, Westbury Road, Barking, Essex, clerk. Minimum cash subscription, £7. Registered office: Finsbury Pavement House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lancashire Electrical Engineering Co., Ltd.—Debenture dated August 22nd, 1917, to secure £200, charged on freehold works at Ashton-under-Lyne, and the company's general assets. Holder: A. Seymour, Ashton-under-Lyne.

Clevedon, Portishead & District Electric Supply Co.—Particulars of £5,000 debentures created August 14th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

British Westinghouse Electric & Manufacturing Co., Ltd.—Particulars of £500,000 second mortgage debentures created May 7th, and secured by trust deed dated August 22nd, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908. None of the debentures are issued at present. Property charged: Certain lands and buildings at Stretford, Lancs., and the company's undertaking and property, present and future, including uncalled capital. Trustees: Trustees Corporation, Ltd.

Wright & Wood, Ltd.—Mortgage dated August 29th, 1917, to secure £520 16s., charged on land at Halifax. Holders: Halifax Permanent Benefit Building Society.

Foster Construction Co., Ltd.—Charge on proceeds of Government contract for steel work (total amount £4,420), dated August 18th, 1917, to secure all moneys due or to become due from company to London and South-Western Bank.

Electric Construction Co., Ltd. (39,292).—Capital, £400,000 in 300,000 ord. and 100,000 pref. shares of £1 each. Return dated June 14th, 1917. 224,200 ord. and 62,780 pref. shares taken up; £40,690 paid on 4,200 ord. and 36,490 pref.; £246,290 considered as paid on 220,000 ord. and 26,290 pref. Mortgages and charges: £165,000.

Electric & General Investment Co., Ltd. (31,506).—Capital, £201,500 in 19,900 pref. and 20,000 ord. shares of £5 each, and 40,000 def. shares of 1s. each. Return dated July 17th, 1917. All shares taken up. £5 per share called up on the pref., £1 per share on the ord., and 1s. per share on the def.; £121,500 paid. Mortgages and charges: £26,681.

Evershed & Vignoles, Ltd. (43,206).—Capital, £30,000 in £10 shares. Return dated July 6th, 1917. All shares taken up. £30,000 paid. Mortgages and charges: £15,000.

D.P. Battery Co., Ltd. (44,084).—Capital, £10,000 in 4,996 "A," 4,996 "B," and eight other shares of £1 each. Return dated July 26th, 1917. 10,000 shares taken up; £10,000 paid. Mortgages and charges: £18,000.

Electrical Engineering & Equipment Co., Ltd. (115,089).—Capital, £10,000 in £1 shares. Return dated July 20th, 1917. 4,002 shares taken up; £4,002 paid. Mortgages and charges: Nil.

CITY NOTES.

County of Dorset Electric Supply Co., Ltd.

At the annual meeting, held in July, Dr. J. A. Hosker, who presided, said that there had been during the year a setback in the development of the undertaking. The gross profit at £937 showed a decrease of £334, and after allowing for interest on loan and hire-purchase agreement there was a net deficit of £72. Cost of fuel and all materials had enormously advanced, and the use of lighting current was restricted. It was impossible to obtain materials for extensions, so that additional customers could only be connected to the mains already laid. Thirty new consumers had been added, bringing the lamps connected up from 15,448 to 20,426. The units sold were 207,252, against 193,458. The Swanage and Lyme Regis companies showed a profit on working, and Blandford a small loss. When times became normal again the rate of progress would become considerably accelerated. The estimated receipts for the first six months of this year were £1,871, against £1,664 in the corresponding period of last year. Lieut.-Col. W. H. Baxter, a director, had been killed on active service, and three other directors were engaged on military duties, and upwards of a third of the staff were with the Colours.

Globe Telegraph & Trust Co., Ltd.—Interim dividend of 2s. per share on ordinary shares, free of tax, for the past quarter.

Direct Spanish Telegraph Co., Ltd.—In addition to the dividend at the rate of 10 per cent. per annum on the preference shares, an interim dividend at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares is announced, both for the half-year ended June 30th.

British Insulated & Helsby Cables, Ltd.—Interim dividend of 7½ per cent. (7s. 6d. per share), less income-tax, on ordinary shares, as compared with 5 per cent. for the corresponding period of last year.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1¼ per cent. for the quarter ending September 30th on the common capital stock.

British Aluminium Co., Ltd.—Dividends at the rate of 8 per cent. per annum on the ordinary and 6 per cent. on the preference shares, both less income-tax, for the half-year ended June.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax, on the preference shares for the quarter ended September 30th; second quarterly dividend of 1¼ per cent. on the ordinary, free of tax.

Eastern Extension, Australasia & China Telegraph Co., Ltd.—Second quarterly dividend 3s. per share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have recovered their balance, thanks to the better news from Russia. Moreover, the Swedish incident has ceased to be any pronounced factor for the time being. All stocks and shares connected with Russia have improved sensibly, and this has had a decided effect upon the investment departments more particularly.

Money continues to pour into the Stock Exchange from the provinces. Possibly there is less speculation for the time being amongst industrial shares; but the rubber market furnishes conclusive evidence of the way in which buyers in the North and the West of England are ready to look at anything which promises a reasonable hope of a rise in price.

The Home Railway market continues to be one of the few glum parts of the House. There is a slightly better tone about the stocks, and the latest settlement of the Labour dispute in Scotland was declared to have a steadying effect upon prices. All the same, people decline to look at stocks in this section; and the Undergrounds have once more relapsed into their customary condition of quietude. Underground incomes remain at 82½ ex dividend.

About half-a-dozen of the leading shares in the home electricity list are quoted ex dividend, amongst them being the ordinary and preference of the City of London and the County of London companies. There is not much change in the quotations, allowing for these markings, but Bromptons at 6½ are 5s. up, and Westminsters have again advanced, this time to 6¾. There is a noticeable demand for all the shares in the group; and the reversion once more to Greenwich time has quickened, as we were pointing out last week, the interest taken in illumination companies.

The manufacturing market is decidedly good. Callenders have risen to 14¼, General Electric ordinary to 17, and India-Rubber shares to 13¾. So far as the last-named are concerned, there are buyers about at the price, but holders are retaining their shares, and seem perfectly content to keep them, notwithstanding the sustained rise which has occurred during the past two or three months. Business continues active in the various Edison Swan shares, though there has been something of a reaction from the best, due to profit-taking. Moreover, in the absence of more detailed information, the tendency is to go a little slowly. The 7 per cent. preference shares are changing hands on the basis of 1 1/16, and those 10s. paid at 11s. 3d.

The Mexican group is again dull. Mexico Trams and Mexican Light & Power issues are both rather lower, with the exception of the 6 per cent. bonds of the former company, which have risen to 40. Brazil Tractions went back to 46, most issues connected with the Republic having eased off because of the continued dulness in the rate of exchange. The 4½ per cent. debenture stock of the British Columbia Electric Railway is quoted ex dividend, and at the present price of 52 the yield once more looks tempting.

Globe Telegraph & Trust shares of both classes are better, the ordinary rising to 13 and the preference to 10½, these showing rises of 5s. and 2s. 6d. respectively. The attraction in the ordinary shares is, of course, the fact that the dividends are still paid free of tax. The Eastern group is steady, and Anglo-American preferred at 98½ shows a rise of the fraction. Marconis at their nominal price of 3½ are not quite so good as they look, there being sellers about in the market at this figure. Oriental Telephones eased off to 3½, and United River Plates to 6⅞, which is not very surprising considering the way in which the prices of both have been rising of late. West India and Panama also are a little easier at 28s. 9d.

The Direct Spanish Telegraph Co. has declared its usual interim dividend at the rate of 4 per cent., free of income-tax, on the ordinary shares, and the price keeps very firm at 5¼; while the 10 per cent. cumulative preference changed hands about a month ago at 7½. Business has been done this week in Direct United States Cable shares at 6⅞; and the demand for these stocks has reached the prior-charge issues, Eastern 3½ per cent. preference being done lately at 61, and the 4 per cent. mortgage debenture stock at 72. These prices, it may be added, compare with 77½ and 96½ respectively at the outbreak of war, when, it may be superfluous to recall, the value of money was very different from what it is to-day. Western 4 per cent. debenture stock stands at 73, and Eastern Extension 4 per cent. debenture stock at the same price.

The activity in the rubber market has already been mentioned, and prices are forced up by the persistence of the buying from the provinces. The armament group, too, is good, with Armstrongs up to all but 40s. There is more doing in the tin section, and the big rise which has taken place in the price of silver is having its due effect upon the shares in companies connected with the metal.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price Sept. 18, 1917.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	9	6¼	+ ¼	£6 18 6
Charing Cross Ordinary	5	5	8¾	—	6 9 0
do. do. do. 4½ Pref.	4½	4½	38	—	6 18 4
Chelsea	4	8	8½xd	—	5 9 1
City of London	8	8	12½xd	—	6 4 8
do. do. 6 per cent. Pref.	6	6	10½xd	—	5 15 5
County of London	7	7	11½xd	—	6 5 10
do. 6 per cent. Pref.	6	6	10xd	—	6 0 0
Kensington Ordinary	7	6	5½	—	6 14 8
London Electric	8	8	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8½	—	5 6 8
Metropolitan	8	8	8	—	5 0 0
do. 4½ per cent. Pref.	4½	4½	8½	—	7 4 8
St. James' and Pall Mall	8	8	7	—	5 14 6
South London	6	6	9½	—	7 5 6
South Metropolitan Pref.	7	7	21/6	—	6 10 3
Westminster Ordinary	7	7	6¾	+ ¼	6 8 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	+ ½	6 1 10
do. Def.	83/8	1½	23	—	6 10 8
Chile Telephone	8	8	7⅛	—	5 11 4
Cuba Sub. Ord.	6	6	8½	—	5 14 3
Eastern Extension	8	8	14½	—	*6 8 4
Eastern Tel. Ord.	8	8	14⅜	—	*6 7 9
Globe Tel. and T. Ord.	7	7	13	+ ½	*5 7 8
do. Pref.	6	6	10½	+ ¼	5 14 3
Great Northern Tel.	22	24	37	+1	6 9 9
Indo-European	13	13	54½	—	5 19 3
Marconi	10	15	3½	—	4 15 10
Oriental Telephone Ord.	10	10	3½	— ¼	3 4 0
United R. Plate Tel.	8	8	6⅞	— 1/16	*5 16 4
West India and Pan.	6d.	6d.	1/16	— 1/16	3 9 5
Western Telegraph	8	8	14½	—	*5 10 4
Home Rails.					
Central London, Ord. Assented	4	4	83½	—	6 16 9
Metropolitan	1	1	23½	—	4 5 1
do. District	Nil	Nil	16½	—	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A"	Nil	Nil	6/-	—	Nil
do. do. Income	6	4	82½	—	*4 17 6
Foreign Trams, &c.	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	4⅞	—	6 3 1
Anglo-Arg. Trams, First Pref.	6½	6½	8⅛	—	8 19 6
do. 2nd Pref.	5½	—	2⅜	—	—
do. 5 Deb.	5	5	67⅛	—	7 9 3
Brazil Tractions	4	4	46	—1	—
Bombay Electric Pref.	6	6	9⅜	—	6 4 8
British Columbia Elec. Ry. Pfce.	5	5	42½	—	11 15 4
do. do. Preferred	Nil	Nil	81	—	Nil
do. do. Deferred	Nil	Nil	29	—	Nil
do. do. Deb.	4½	4½	52xd	—	8 8 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	46½	—1	Nil
do. 6 per cent. Bonds	Nil	Nil	40	+1½	Nil
Mexican Light Common	Nil	Nil	12½	—	Nil
do. Pref.	Nil	Nil	31	—	Nil
do. 1st Bonds	Nil	Nil	46½	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3½	—	4 15 10
British Aluminium Ord.	7	10	1⅜	—	6 16 8
British Insulated Ord.	17½	20	14	—	7 2 10
British Westinghouse Pref.	7½	7½	9¾	—	5 9 1
Callenders	20	20	14¼	+ ½	6 18 0
do. 5 Pref.	5	5	4½	—	6 1 8
Casmer-Kellner	22	22	3/16	—	6 8 0
Edison Swan, fully paid	—	—	1¾	—	Nil
do. do. 4 per cent. Deb.	4	4	73½	—	5 10 4
Electric Construction	7½	7½	⅛	—	8 0 0
Gen. Elec. Pref.	6	6	10½	—	5 17 1
do. Ord.	10	10	17	+ ¼	5 17 8
Henley	25	25	16	—	7 16 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	13¾	—	*7 5 8
Telegraph Con.	20	20	38½	—	*5 5 3

* Dividends paid free of income-tax.

ELECTRODES FOR ELECTRIC FURNACES: THEIR MANUFACTURE, PROPERTIES, AND UTILISATION.

(*Continued from page 246.*)

Life of Electrodes: Consumption and Protection.—The rate of consumption of electrodes is very variable, depending as it does on the quality of carbons, type of furnace, method of protecting electrodes, and on the manufacturing process concerned. Consumption is due principally to:—(1) Dissociation by the current; the working voltage may be either too high or too low; (2) chemical combination of the electrode with oxygen from oxides in the charge treated, oxidising slags are particularly injurious; (3) solution of carbon in the metal, to form carbides, silico-carbides, &c.; (4) direct oxidation by atmospheric oxygen; this action may be very rapid, owing to the high working temperature. Fig. 7 shows two

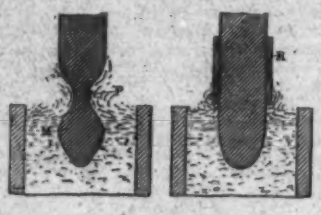

FIG. 7.—UNPROTECTED AND PROTECTED ELECTRODES.

electrodes, one unprotected and one protected by an incombustible insulating sleeve R. That part M of the electrode which is plunged into the charge is protected against oxidation by the oxides of carbon liberated in the furnace. The exposed portion P, on the other hand, is intensely hot and subject to rapid oxidation by the air. A "neck" is formed in the electrode, and the increased electrical resistance at this section causes intense local heating and still more rapid reduction of section, until finally M breaks away—wasting material and possibly spoiling the charge.

One must not burn electrodes too close to the terminal clamps for fear of injuring the latter; but the loss in rejected stumps is a serious item. New electrodes may cost £16 per ton, and stumps may be worth 32s. per ton as raw material for fresh electrodes. The scrap value is thus only 10 per cent. of the value new, and a 5-ft. electrode may have to be rejected when the stump is 2½ ft. long—*i.e.*, there is a waste of nearly 50 per cent. It is now usual to reduce the actual loss by utilising stumps in one way or another. The stumps themselves may be tapped and threaded so as to be screwed together, this process being particularly applicable to

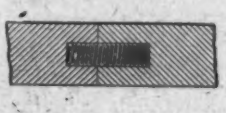

FIG. 8.

FIG. 9.

cylindrical graphite electrodes. Alternatively a copper screw may be used (fig. 8), or a number of pieces may be held together, as in fig. 9, by metal rods *m*; the junction between the pieces is then one of simple contact. In any case, however, trimming the irregular ends of stumps involves more or less waste.

The most effective protection for electrodes consists of a sheath of incombustible material. Mixtures which have been proposed for this purpose are:—Retort coke and sodium silicate; lime and limestone with carbon; and potassium or sodium silicate with chalk. These mixtures applied cold form a covering which is a good resistant to heat. Other protective coatings used are asbestos wool with silicates; milk of white clay; and silundum. The last is an amorphous compound resembling carborundum; it is refractory, incombustible, and (being a compound of carbon and silicon) it is useful for protecting electrodes in ferro-silicon furnaces. An iron netting may be used to support a paste of sodium silicate and clay or of kaolin and asbestos. Sometimes granular material unaffected by oxidising gases is embedded in the surface of the electrode; quartz, alumina, or carborundum may be used according to the nature of the products made in the furnace. Rigid envelopes of asbestos board or sheet-iron have also their uses, though care is required to prevent air circulating between electrode and sheath, which then forms a draught chimney and intensifies the damage.

In this connection, M. Ch. Louis recommends that the electrode be protected by an agglomerate of magnesia or dolomite, 3 to 5 cm. in thickness, inside a jacket of 1-mm. sheet iron. The agglomerate is heated for mixing, and contains 6 to 7 per cent. of pitch and 5 to 8 per cent. of tar. Adherence on the electrode is increased by chipping its surface and painting it with tar. The sheath being held in place by an external mould, the agglomerate is packed tightly between it and the electrode. The mould is then withdrawn and a joint is made at the top, between sheath and electrode, by a paste of silicate or refractory earth. It is not essential to re-bake an electrode thus protected.

The Gin process is to embed the electrodes in a carbon agglomerate. With this end in view, the electrodes are formed of several cores (say, eight or ten), and the agglomerate is a mixture of coke or ground electrode stumps with pitch or tar. The agglomerate forms simply a mechanical bond between the electrodes; it is not traversed by any considerable fraction of the current, and is, therefore, at a much lower temperature than the cores, and is less exposed to oxidation. Its protective action endures beyond the point in the furnace at which iron sheathing would be melted away.

Important though it is to reduce wasteful consumption of electrodes, it is evident that a protective coating of any sort carries its impurities into the manufactured product, and for this reason it is sometimes better to do without the coating and simply modify the shape of the electrodes. In several aluminium works, for instance, very short electrodes are used in the shape of truncated pyramids with the larger end above. The use of short electrodes is undoubtedly the best policy when protection against oxidation cannot be obtained effectively and acceptably.

The rate of electrode consumption referred to unit weight of product manufactured varies widely with the product concerned, and with the type of furnace employed. For instance, in the manufacture of 25 per cent. ferro-silicon, the electrode consumption is about 3 mm. per hour, increasing to 4 mm. per hour when a 58 per cent. silicon alloy is made. Manganese-silicon alloys involve a mean consumption of 3 mm. and calcium carbide of 2 mm. per hour. All these figures refer to covered furnaces charged continuously, in which consumption is always a minimum.

In aluminium manufacture the electrode acts not only as current conductor, but also as comburent, and its consumption is generally proportional to the quantity of metal produced—say, 700 gm. per kg. (1,560 lb. per ton) of metal produced.

In steel furnaces of direct-production type, with electrodes about 2 metres long, consumption varies with the process. The following table shows the net weight of electrodes burned effectively* in various works:—

Furnace.		Electrode consumption per ton of steel. Kg.	Lb.	Remarks.
Stassano, Turin	...	7 to 10	15½ to 22	charged cold
Girod, Ugine	...	11·4	25	—
Chapelet, Allevard	...	11·3	24·8	—
Heroult, Le Praz	...	17·5	38·5	—
Lindenburg, Remscheid		2·68	5·9	fluid charge.

Allowing for stumps capable of utilisation and starting directly from ore, the average net consumption of electrodes is now 4 to 5 kg. (8¾ to 11 lb.) per ton of steel. In some cases, electrodes have lasted for 1,200 working hours, corresponding to more than six weeks of continuous operation.

Electrode Carriers and Terminals: Cooling Arrangements.—The manner in which electrodes are supported, whilst being left free for up and down adjustment at will, and the manner in which connection is made to the electric supply mains, play an important part in the maintenance and durability of electrodes. Bad fitting

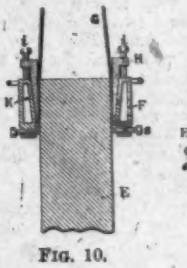

FIG. 10.

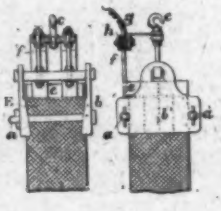

FIG. 11.

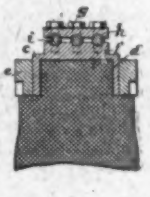

FIG. 12.

may cause the electrode to become red hot at places, and this in turn leads to breakage or excessive combustion; the damage is cumulative, because the resistance of carbon decreases with increasing temperature, hence current passes by preference through the overheated parts, aggravating their state and exposing them to yet more rapid depreciation.

Defective connections involve serious expense. In one works the maintenance cost for electrode connections alone used to amount to 6s. 6d. per ton of metal produced; subsequently this figure was reduced to 1s. 7d. per ton by various improvements. A saving of £950 per annum was thus effected in this single expense, on an annual production of 4,000 tons.

There are several methods available for the attachment of carriers to electrodes, but the two types at present in use are clamp connections and central connections. Examples of these types are illustrated in figs. 10-14 and figs. 15-18 respectively.

Clamp Connections.—The head clamp shown in fig. 10 consists of a hollow annular piece F, the cavity K in which serves for the circulation of cooling water under pressure. The copper pieces G serve at once for the suspension of the electrode, and for its connection to the supply cables; they are held against the electrode by bronze or cast-iron wedges H, the latter being drawn tight by bolts *i*. The ring P is held in place by set screws *e*, and flexible metal tubing is used to carry water to and from the jacket.

The dovetail clamp illustrated in fig. 11 is used in certain carbide furnaces, the head E of the electrode being dovetailed to fit the cast-iron clamps *b*, which are held by cotter bolts *a*. An iron framework engages with the side pieces *b*, and is provided with an

* That is to say, allowing for stumps capable of being utilised either by fixing them to new electrodes, or by using them in alloy furnaces for producing ferro-silicon, &c.

electrically-insulated suspending hook *c*. Copper plates *e* and *f* are clamped at *h* to the supply cable *g*, and the weight of the electrode ensures firm contact.

Fig. 12 shows an electrode cut back to accommodate a copper cap *c*; good contact is secured by filling with liquid aluminium *d*, or with some other metal of comparatively high melting point. The cap *c* is clamped by an iron shrink-ring *e*, which just slides into place at red heat, and is applied whilst the joint metal *d* is still liquid. The contraction which occurs as the joint cools, ensures excellent contact between the cap, the joint-metal and the electrode. Supply leads *i* are held in machined grooves on the head *f* of the cap by a cover plate *h* and studs *g*. This arrangement gives very good results in service.

Cooling may be secured in all these cases by a water basin near the connection or by a trough of water *w* (fig. 13) surrounding the

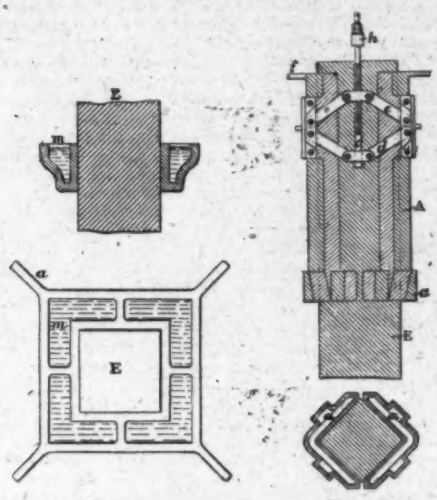

Fig. 13.

Fig. 14.

electrode E, and provided, if necessary, with radiating ribs or wings *a*.

The lateral connection shown in elevation and section in fig. 14 was devised by Louis for use in certain steel-smelting furnaces. The electrode is clamped between two hollow jaws of V-shape by a pincer mechanism. The clamps are carried from a horizontal beam *h* by two rods *c*, screwed for part of their length and connected to the jaws by jointed rods *e d*. The jaws are opened or closed by turning *c* in the appropriate direction. When closed, the toggle mechanism exerts a very powerful grip on the electrode. It is convenient and economical to feed the electrode through the clamps (which are slackened temporarily for the purpose), as it is consumed. A connector of this type can be used efficiently for electrodes of slightly different sizes. The supply cables or strips are attached to the pieces *f*, and a padding of copper gauze between jaws and electrode ensures intimate contact even though the corners of the carbon are not quite square. Water is circulated under pressure through the jaws for cooling purposes.

Central Attachment.—Several means for effecting central connections to the ends of electrodes are illustrated in figs. 15—18. In fig. 15 the rod A has a screwed portion *m*, which engages

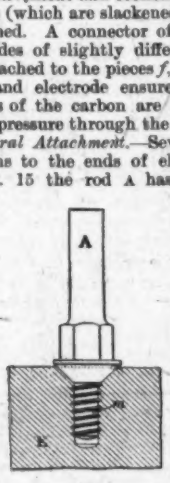

Fig. 15.

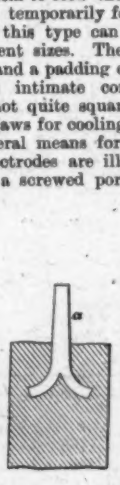

Fig. 16.

Fig. 17.

directly in the electrode. Several electrodes (generally four) may be grouped on a single supply cable and supported and adjusted by a rack, with hand or motor-driven gear.

Central axial connection is particularly convenient in certain classes of manufacture and in aluminium works; for instance, the electrodes are often carried by a simple piece of iron—*a*, fig. 16—split and bent to hook shape and embedded in the electrode, before or after baking.

The bronze connector shown in fig. 17 is made hollow for water cooling. Fresh water is supplied at *d* in the basin *a*, and runs into the hollow stem *f*. Overflow runs into the annular reservoir *h*, whence it evaporates; no water reaches the joint between connector and electrode. The recess in the latter for the reception of the connector is larger at the bottom than at the top, and is made with such clearance that molten bronze *k* can be poured in, to effect connection between B and A, both of which are heated before casting the joint. The bronze used for the joint should be an alloy with fairly low melting point and small contraction. An ingenious means is used to remedy any imperfection in contact due to contraction of the bronze; this consists in running molten tin round the joint at *l*, after cooling. Should the joint become hot in service, owing to imperfect initial contact, the tin melts, flows into the interstices, and effects thoroughly satisfactory contact. The whole of the joint metal may be retrieved when changing electrodes.

In small furnaces the electrodes may be supported and connected to the supply cable by a simple brass eye-bolt, such as that shown in fig. 18.

Hand or Motor Control.—The simplest method of adjusting the position of electrodes is to bring the suspending chain or cable to a winch which may be operated manually or by a hand-controlled motor. This control necessitates more or less continuous attention and loss of time both in control and in furnace operation. For this reason, automatic control is to be preferred. A Thury type D.C. or A.C. regulator may be used to control a starting and reversing switch, and thus start in one direction or the other, a servo-motor geared to the electrode mechanism (fig. 19).

The supply cables may be bolted or welded to the electrode terminals, but flexible conductors must be used in either case. In order to eliminate any appreciable restraint on the movement of

Fig. 18.

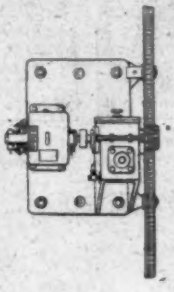

Fig. 19.

Fig. 20.

the electrodes and to reduce the risk of melting the flexible connections, Keller uses strips of thin, flexible copper attached to two symmetrical supports and bent to zig-zag form. Rings *b*, *b* (fig. 20) prevent the strips from sagging into the flames or causing short circuits.

Where several electrodes are used simultaneously in a single furnace, it must be possible to manipulate the electrodes separately or simultaneously. A variety of mechanisms and controls is available for this purpose.

(*To be concluded.*)

THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).—I.

Annual Conference.

Yesterday the annual conference of the Association was opened at Blackpool, the reading of the Presidential Address by Mr. Henry Mozley (general manager, Corporation Tramways, Burnley) being the first item on the agenda.

After referring to the circumstances which had compelled the suspension of new construction for the time being, Mr. Mozley said that ever since his introduction to municipal life he had felt it an absurdity to repay the whole capital, within very limited periods, of an industry like that of the tramways, which was ever growing in value. Why should the first generation of inhabitants make a present to the second generation of property bringing in thousands a year, when this could only be done by burdening themselves with heavy charges annually, instead of taking a legitimate toll or dividend for the moneys expended? He suggested that the policy of municipal authorities providing sinking funds for everything alike, whether for a pure business undertaking such as a tramway, or for works necessary for the conveniences of life, such as streets, sewerage, parks, &c., was wrong; although it might be law, it was the business of this Association to get the law altered. Certain undertakings had felt the inconvenience of the sinking fund especially during the war, but there did not appear to be any prospect of temporarily obtaining powers to suspend the charge, with the consequence that the rates had become liable, and this naturally led to the consideration of fares and their effect on the financial position. Unlike the railway companies, municipal authorities after securing certain statutory fares began to give very much cheaper fares, both for workpeople and ordinary passengers, and in some cases this policy was being continued with disastrous consequences to the financial stability of the undertaking. The Association should exert its influence to help such undertakings to remedy such errors, and secure more uniformity in charges. It was the common experience of all to have flung at them such remarks as

"such and such a tramway gives three miles for a penny, why can't you?" Probably it would be useless to tell the person that the cost of carrying a passenger three miles was considerably in excess of one penny, and that the loss was made up from the shorter journey passenger. It would be better, before taking any steps to secure legislation, for the undertakings concerned to put into operation the power they already possessed of increasing fares, and by open discussion at their meetings healthier and more reasonable views might be created.

In recent years the tramway industry had benefited by standardisation of material used in common, but local standardisation was also desirable; for convenient and economical working all cars should be alike in design and dimension on separate undertakings, and in the case of those having connections with neighbouring tramways and light railways, not only would more economical working be secured, but interchange of rolling stock would be facilitated, and neighbouring tramways might thus assist each other in ordinary development and emergencies. If the Association could do anything to ascertain the best type and most economical car to use, it would confer a great benefit on the industry in the way of cheaper working and convenience in operation. As time went on, and intercommunication was developed, this question would become very important.

From time to time they heard of difficulties and inconveniences arising owing to the long period which had elapsed since the Tramway Act of 1870 became law, and he suggested that it should be made the business of the Association, in combination with the Association representing company undertakings, to take up the revision of the conditions brought about by that Act, and secure more liberty in carrying on the tramway business. There should be one tramway authority in combined areas to control all traffic problems and developments, with representative boards. Every one must be conscious of the incomplete effect of a number of small undertakings operating in what was practically the same district, whereas, if combined, the result would not only be more economical working, but a greatly increased convenience to the public. In these days of manufacturing syndicates what an advantage it would be if combined tramway undertakings could buy their material in bulk. Why should there be any restriction as regards manufacturing for one's own requirements—either cars, working parts, or other material in daily use? The power to do this should be secured by law.

In common with the rest of the business community, it behoved them to prepare for the great changes which were bound to come after the war. Amongst other subjects the questions suggested by the Whitley Report, issued by the Reconstruction Committee, should receive the immediate attention of the Association. Here, at least, they were in a position to carry out without delay one of the principal recommendations, viz.: "The establishment for each industry of an organisation representative of employers and workpeople, to have as its object the regular consideration of matters affecting the progress and well-being of the trade from the point of view of all those engaged in it."

Their organisation being national, and areas being provided in most cases with local associations, they had only one step forward to take, that was to invite representatives of the workpeople to share their conferences and responsibilities. There must be some better way of arriving at agreements for working conditions, wages, &c., than the present inequitable and slow one. Agreements amongst themselves were better than the impositions of an outside and unsympathetic authority.

Tramway Finance.

Some notes on this subject were contributed by Messrs. J. Barnard (Bolton), G. W. Holford (Salford), and P. Priestly (Oldham). The authors dealt with the main features of the income and expenditure sides of tramway undertakings.

Income.

Fares.—The usual rate stipulated in the Acts of Parliament was 1d. a mile, and in some cases this rate was in operation. How, then, could the revenue be increased? By lowering the rates more riders might be attracted, but this could only be done by reducing the penny stage to a halfpenny one—a course to which the authors were most strongly opposed—or by lengthening the stages. In either case a considerable increase in the number of passengers carried had to take place before the previous revenue was obtainable, and local conditions must decide whether a sufficient increase would take place to ensure a larger revenue. The only alternative was to increase the rate chargeable per mile, which required the sanction of Parliament; this question was receiving the attention of the Executive Councils of the Association and the Tramways and Light Railways Association. Many undertakings which had been charging less than the statutory limit had increased their fares, with satisfactory results.

Workmen's fares were subject to a maximum of ½d. per mile, and undertakings which charged that rate could not increase the revenue from this source without statutory authority. Little benefit resulted from the introduction of return fares at a cheaper rate, as in most cases the passenger would return by car, even if he had to pay the single fare for each journey. Even where a profit was shown on the whole, it might be found that the early morning passengers were being carried at a loss, and the passengers paying the usual fares were contributing to make up this loss.

In some instances children's fares were on too liberal a scale. Many concessions had been granted to various sections of the community, and the authors held that they should be withdrawn.

Parcels.—Additional revenue might be obtainable from this source with careful management, and under favourable conditions, but as the use of cars, &c., was not usually charged up against the parcels service, it was questionable whether the system was actually profitable, even where a credit balance was shown. Moreover, the parcels service might have a detrimental effect upon the passenger service.

Advertising.—In the authors' experience the value of a tramcar as an advertising medium was on the down grade, and they did not recommend the practice.

Investments.—The tramway fund should be credited with all the interest accruing from its investments, which in some cases was credited to the general fund account of the Corporation.

Expenditure.

Power.—This was a very important item as regarded both the energy consumed per car-mile and the cost per unit. The consumption varied widely, owing to local conditions, and the price charged to the tramway department was in many cases unfair as compared with the terms offered to manufacturers. The authors held that as soon as the price of coal began to cheapen the price of electrical energy should be reduced in many undertakings, and that a sliding scale with regard to the price of coal should be provided for. Much energy could be saved by careful driving, and systematic inspection of the electrical equipment of the cars; directly things became more normal a thorough overhaul of all electrical and mechanical working parts of the car equipments should be carried out. Car meters, with careful examination of the records, were strongly recommended.

Traffic Expenses.—Some system of standardisation of wages, with a properly constituted authority to settle differences and disputes, was desirable. Labour and materials should be carefully economised, but not by the adoption of inferior quality.

Insurances.—The authors were of opinion that it would be found more economical and satisfactory for each undertaking to carry its own risks.

Repairs and Maintenance.—Here again the utmost economy was necessary, but provision should be made to repair the permanent way in the near future.

The authors concluded with a declaration that municipal tramway undertakings should at all times be regarded as commercial enterprises, and that provision should invariably be made for depreciation and renewals on a sound financial basis before contributions were demanded for the relief of rates or any other purpose.

Differentiation in Fares.

In his paper on this subject, Mr. W. Murray (tramway manager, Walthamstow U.D.C.) also dealt with the question of workmen's fares. He pointed out that tramways—at least, in London—were meeting with keen competition in respect of speed and fares, coupled with enormously increased expenses. Differentiation in fares in favour of *bona-fide* workmen was compulsory, although it meant running at a loss, and such services were kept down to the minimum by the companies which first took up tramway work as a business enterprise. Municipalities, however, had increased them and reduced the fares, so that in London there was a continuous stream of workmen's cars between 3.30 and 8 a.m., special cars between noon and 2 p.m., and again between 5 and 7 p.m., to cope with this traffic, and a rate of 10 miles for 2d. (in one case 19 miles for 2d.) seemed to be about the average. Temperate comment on this state of affairs was difficult. Moreover, many tramway systems allowed all passengers boarding cars before 8 a.m. to purchase return tickets at workmen's rates, which involved a loss to the undertakings. Other concessions had been granted, to school children, blind people, &c., and he submitted that the whole system of differential fares and free travelling was utterly wrong, the only true basis for the fixing of tramway fares being the cost of providing the service rendered, all who availed themselves of that service being required to pay on a uniform scale. There was no justification for carrying a highly-paid mechanic for less than a clerk or shop girl, nor should tramway employés be allowed to travel free. Travelling facilities cost money, like any article of commerce, and to overcharge some sections of the community in order to make good a loss on others was morally indefensible.

In the author's opinion, all municipal tramway undertakings ought to raise workmen's fares to the legal limit, cancel all free passes, and withdraw all special rates. If this could not be done, then the Council concerned should purchase from the tramway department tickets *at face value*, and distribute them at a reduced price, or entirely free, if thought desirable. This course would free the tramway department from a very serious and unfair handicap, would remove the injustice to ordinary passengers, and would bring home to the public and the council the cost of such conces-

sions. Further, the Executive of the Association should seriously consider what steps could be taken to secure an alteration in the law regarding workmen's fares. If, on the other hand, tramways *must* go on bearing this burden of preferential rates, in common fairness they ought to be protected from unnecessary and grossly unfair competition.

Other matters that were to be dealt with yesterday were the "Rule of Footpath," introduced for discussion by Mr. J. Dalrymple (general manager, Glasgow), and "Development of Tramways," introduced by Mr. Arthur Ellis (city electrical engineer and tramways manager, Cardiff). To-day an extraordinary general meeting is to be held to confirm alterations to the Articles of Association, and the annual general meeting will follow.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

RUSSIA.—A Decree of the Provisional Government was promulgated on July 28th prohibiting, as a temporary measure, the importation of all goods except under licence issued by the "Foreign Supplies Department," or by the Minister of Commerce. The Decree was to come into force from the day that the Customs authorities received telegraphic notice to that effect, but it will not apply to consignments of goods which are shown by the bills of lading, way bills, or port permits, to have been dispatched within three weeks from the date of promulgation of the Decree. The Minister of Commerce is to draw up a list of goods which are not to be subject to this prohibition. Consignments which arrive in Russia, for which the necessary licence has not been obtained, are liable to confiscation.

SWEDEN.—The exportation of the following, among other articles, has been prohibited as from the dates mentioned:—

June 15th: Accumulator cells or batteries, wholly or partly mounted; also electrodes soldered together.

July 23rd: Mica, unmanufactured or pulverised; mica manufactures not specially mentioned in the Customs Tariff.

August 2nd: *Electrical machines, such as generators, motors, converters, transformers, and damping rollers; stators, rotors, current collectors, magnet coils, brush holders, and armature coils exported separately; also parts of all the foregoing—provided they are composed to any extent of non-precious metal other than iron, or are tinned to any extent; accumulators—unmounted cells; incandescent lamps; arc lamps, even if with the globes belonging to them; so-called Nernst lamps, and globes, luminous bodies and resistances for the same; searchlights; carbon filaments, even if metallised; metal filaments and bases for electric lamps; carbon brushes (weighing less than 3 kilogs. each), even if combined with other material; safety appliances mounted on porcelain insulators (not plates); starting, regulating, and reduction resistances; controls and other electric regulators; also fitted boards for electric apparatus and instruments; *switches, current interruptors and reverses, and incandescent lamp sockets with or without switches; telephone apparatus; telegraph apparatus, telephone switches and telephone switchboards, also unspecified parts of telegraph and telephone apparatus and of telephone switches and switchboards; *special apparatus for electrical purposes, not specially mentioned,* such as apparatus for signalling or conveying messages, Röntgen ray apparatus, apparatus for wireless telegraphy and telephony not included elsewhere, ore separators, &c.; also jack panels for telephone switchboards.

MOROCCO.—The Board of Trade have received from H.M. Minister at Tangier a copy of a new Tariff of valuations of the principal articles of merchandise imported into Morocco. These valuations form the basis on which Customs duties are to be assessed during the second half of the current year. [Goods imported by sea are, with certain exceptions, subject to duty at the rate of 10 per cent. *ad val.*, and also to the special tax of 2½ per cent. *ad val.* imposed by the Algeciras Act.]

The new valuation Tariff may be consulted at the Department of Commercial Intelligence, 73, Basinghall Street, E.C. 2.

TRANSIT OF GOODS TO SWITZERLAND *vid* ITALY.—In connection with the regulations referred to in the preceding notice, the Board of Trade are informed that arrangements have been made for the issue by H.M. Customs of the "pink certificates," S. 45 A and S. 45 B, in respect of consignments of goods which are exported under licence from the United Kingdom to Switzerland *vid* Italy.

JAPAN.—Under an Order of the Department of Agriculture and Commerce the exportation of the following articles from Japan is permitted as from July 1st, provided that the special authority of the Department is obtained:—Tin ore and chloride of tin; nickel ore, nickel, and ferro-nickel; manganese ore, spiegeleisen and ferro-manganese; cobalt ore, cobalt, and ferro-cobalt; molybdenum and ferro-molybdenum; tungsten and ferro-tungsten; antimony; graphite; and mica and manufactures of mica.

* Extension of existing prohibition.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

12,615. "Sparking plugs." A. E. Lamkin. September 3rd.
12,622. "Telegraphic relays." H. W. Sullivan. September 3rd.
12,629. "Sound filters applicable to telephone receivers, gramophones, &c." C. Teasdale-Buckell. September 4th.
12,655. "Portable electric lamps." H. Brenner, Ross & Co. and J. Smith. September 4th.
12,712. "Receivers for wireless telegraphy." O. D. Lucas. September 5th.
12,721. "Interrupters for electric circuits." H. W. F. Ireland. September 5th.
12,724. "Electro-pneumatic braking systems." W. V. Turner. September 5th. (U.S.A., March 29th.)
12,727. "Electro-pneumatic braking systems." W. V. Turner. September 5th. (U.S.A., April 17th.)
12,787. "Flash lamp." C. J. Harvey & H. W. Hooper. September 6th.
12,789. "Magnetos." G. M. Turner. September 6th.
12,796. "Device for indicating condition of secondary electric batteries or accumulators." W. E. Batt, Chloride Electrical Storage Co. & H. Dean. September 6th.
12,814. "X-ray tube, stand, and table." E. E. Greville. September 6th.
12,816. "Electric induction furnaces." H. Cornthwaite & S. Cornthwaite. September 7th.
12,819. "Electric vehicle or locomotive trolley-pole manipulating means." J. L. Carr. September 7th.
12,830. "Electric ignition, lighting, and starting of internal-combustion engine driven vehicles." E. Harrison. September 7th.
12,854. "Controlling means for electrically-operated feed-reel brakes." H. V. James. September 7th.
12,855. "Systems of control for electric motors operating cranes, &c." J. Bentley & W. H. Scott. September 7th.
12,857. "Electrical resistances." F. A. Ross. September 7th.
12,858. "Automatic circuit-changing switches." L. Polinkowsky and Western Electric Co. (Western Electric Co. partly). September 7th.
12,911. "Wireless telegraph transmitters." C. S. Franklin & Marconi's Wireless Telegraph Co. September 8th.
12,916. "Stabilising guns, searchlights, &c., by gyroscopes." O. Imray (Schilowsky). September 8th.
12,917. "Apparatus for electrical transmission of rotary motion of signals." O. Imray (Schilowsky). September 8th.

PUBLISHED SPECIFICATIONS.

1915.

12,883. Electromechanical Locks for the Gates or Doors of Electric Lifts or the like. D. M. Scott. September 8th, 1915.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

2,375. Combined Plug, Socket, and Switch Devices for Electric Circuits. Y. Hope. August 17th, 1916. (108,685.)
6,702. Electrolytic Deposition of Copper from Acid Solution. F. R. Studt. May 10th, 1916. (Cognate application, 14,467/16.) (108,688.)
6,780. Electric Heat Radiators. A. F. Berry. May 11th, 1916. (108,689.)
11,381. Electric Knife Switches. R. Lister. August 11th, 1916. (108,703.)
11,393. Engine Starting, Lighting, and/or Heating Apparatus for use on Motor and other Vehicles. W. F. W. Rhodes & J. Firth. August 12th, 1916. (Addition to 9,203/16.) (108,704.)
11,429. Bi-polar Electrode Electrolysers. G. G. Hepburn. August 12th, 1916. (Cognate application, 12,903/16. Addition to 12,730/15.) (108,707.)
11,604. Automatic and Semi-automatic Telephone Systems. Relay Automatic Telephone Co. & W. Aitken. August 16th, 1916. (108,714.)
11,605. Automatic and Semi-automatic Telephone Systems. Relay Automatic Telephone Co. & W. Aitken. August 16th, 1916. (108,715.)
11,617. Electrically-operated Indicator Mechanism. W. R. Sykes' Interlocking Signal Co. & R. W. Tarrant. August 16th, 1916. (108,717.)
11,710. Apparatus for Heating Water and other Liquids Electrically. A. Charles. August 18th, 1916. (108,723.)
11,769. Electric Motor Gyroscopes and Means for making Electrical Connection therewith. Crucible Steel Co. of America. November 3rd, 1915. (Addition to 11,752/16.) (102,044.)
11,780. Electric Transformers. British Electric Transformer Co. & S. C. Mount. August 19th, 1916. (108,727.)
11,836. Electrically-operated Clocks and the like. W. Alldis. August 21st, 1916. (108,729.)
12,290. Ignition Terminals, more particularly for use in Aeroplane Engines. R. G. Booth. August 30th, 1916. (108,745.)
12,535. Electric Signalling Lamps, particularly for Ships. Davey & Co. and T. F. H. James. September 5th, 1916. (108,748.)
12,558. Electro-magnetically-operated Horns. H. Lucas & W. H. Edwards. September 5th, 1916. (108,749.)
12,634. Systems of Electric Motor Control. British Thomson-Houston Co. (General Electric Co., U.S.A.). September 6th, 1916. (108,752.)
12,845. Starting Systems for Internal-combustion Engines. W. A. Chryst. September 30th, 1915. (101,626.)
13,235. Incandescent Electric Lamps. C. E. J. Brandt. September 18th, 1915. (101,547.)
13,277. Telegraphy. G. O. Squier, L. W. Austin & L. Cohen. September 19th, 1916. (108,763.)
13,665. Ignition Mechanism for Internal-combustion Engines. H. R. van Deventer. October 28th, 1915. (101,965.)
13,758. Dynamo-electric Machines. M. Latour. September 7th, 1915. (107,193.)
13,825. Portable Electric Lamps. O. Hoffman & C. Wolter. September 25th, 1915. (101,637.)
13,984. Magnets for Magneto-ignition Apparatus for Explosion or Internal-combustion Motors. C. A. Hult & O. W. Holt. October 2nd, 1916. (108,768.)
14,921. Recording Attachment for Electric Current Measuring and Testing Apparatus. C. E. Hunter & W. J. Davis. October 7th, 1916. (108,770.)
14,355. Sound-operated Circuit Controller. Submarine Wireless Co. May 19th, 1916. (106,463.)
14,951. Gyroscopes. S. Oulianine. October 20th, 1916. (108,776.)
16,661. Electrodes as used for Welding Purposes. M. M. Irvine. November 21st, 1916. (108,789.)
17,507. Electrical Discharge Devices. British Thomson-Houston Co. (General Electric Co., U.S.A.). December 6th, 1916. (108,795.)
17,716. Electric Fuses. W. E. Bradshaw and Callender's Cable & Construction Co. December 9th, 1916. (108,795.)